An Outline of the Vegetation and Flora of the Tararua Mountains.

V. D. ZOTOV, N. L. ELDER, A. D. BEDDIE, G. O. K. SAINSBURY, E. A. HODGSON.

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INTRODUCTION.

History.

THE earliest records on the botany of the Tararua Mountains were made by Buchanan (1874). The first botanist to ascend the mountains was Cockayne (1907), but he published merely a few new records of species. Petrie (1908) was the first to make notes on the vegetation along the route to Mount Hector. He was followed by Aston (1910), who climbed Mt. Holdsworth and a few other places in addition. Aston made some further references to the Tararua plants in his list of species in the Wellington province (1911), and he also published a list of plants of C. Turakirae (1912). Nothing has been published since, except references to the collectors in Cheeseman's *Manual* (1925) and a few remarks by Cockayne (1926, 1928, 1928a) on ecology.

The present authors commenced their investigations at a time when the late Dr. L. Cockayne was still active in the field of botany. It is due very largely to his influence and every possible encouragement that the investigations were undertaken and the energies of the independent investigators ultimately combined in the present paper. The authors are also deeply indebted to Dr. H. H. Allan for his interest in this work, and to many of their tramping friends in whose company the authors have made pleasant trips into some very difficult country.

The aim of this paper is to give an outline of the primitive, or as nearly such as it is preserved this day, plant covering of the mountains, especial attention being paid to the plant distribution, and an attempt being made to give a critically revised and annotated list of species. Zotov and Elder have traversed practically every ridge and river shown on the map, and Beddie has explored very thoroughly the southern portion, especially the area with Mount Matthews as centre.

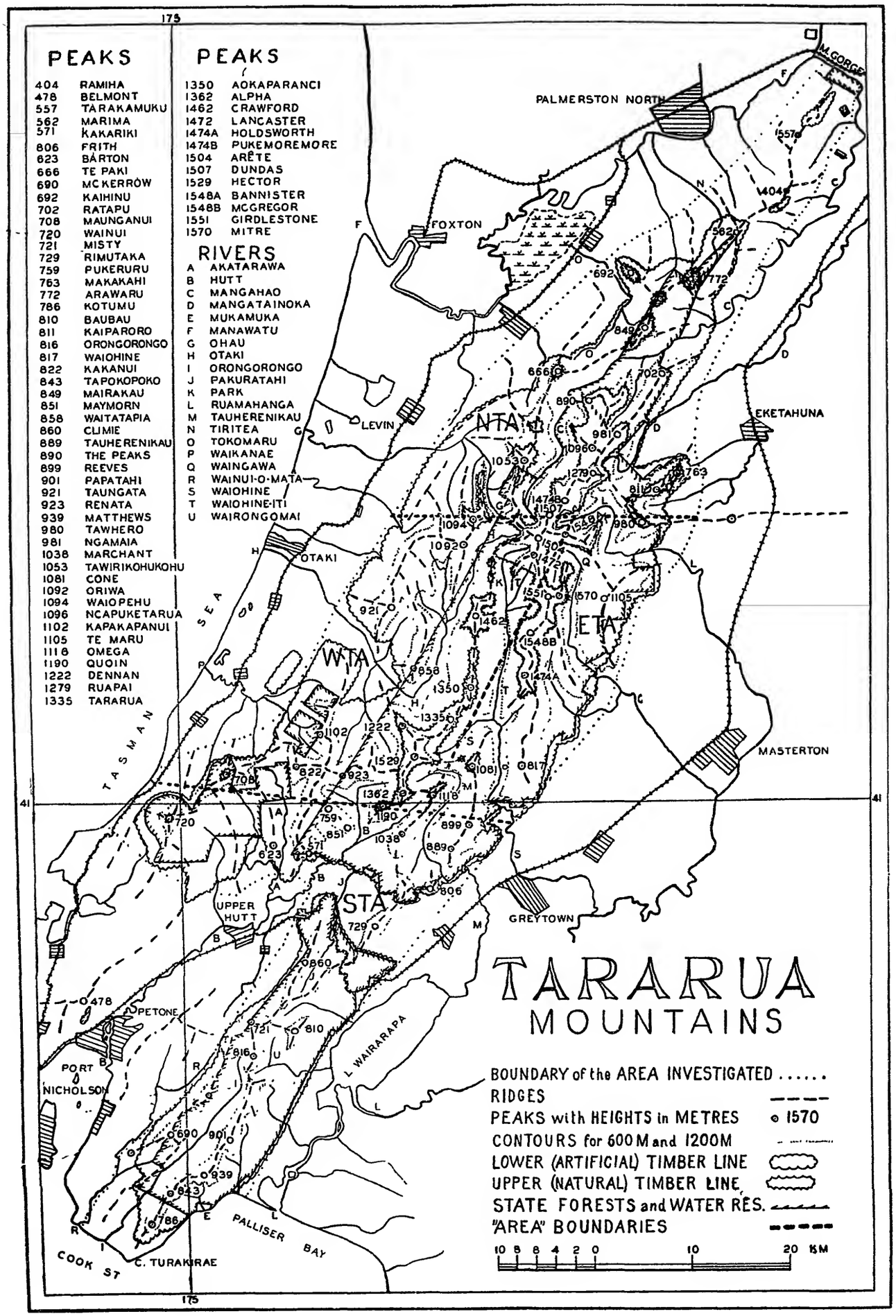
Geology.

The Tararua Mountains represent that position of the main axis of New Zealand mountains running in N.N.E.–S.S.W. direction, which extends from the Manawatu Gorge to Cape Turakirae, being some 150 km. long and 25 km. wide. On the east side they are bounded by the Wairarapa Plains, which rise to about 300 m. towards the middle of the mountains and about the low hills of the main divide, descending plains continuing northward of this. On the west side they are bounded by the Tasman Sea and the Manawatu Plains, which for the most part lie well below 100 m. at the foothills. The hills above the Manawatu Gorge are only about 450 m. high. From here they rise gradually towards the middle until they are about 1500 m., with Mount Arête, 1504 m., in the centre of the watershed, and Mitre, 1570 m., which is off the main range, the highest peak. Continuing southward, the main range often drops well below 1200 m. until Mount Hector, 1529 m., a secondary centre of the system, is reached. From here the range rapidly drops to below 500 m., at Rimutaka Saddle, and then continues under the name of Rimutaka Range, gradually rising towards Cook Strait with Mount Matthews, 939 m., the highest peak overlooking Palliser Bay.

The mountains are built almost entirely of non-fossiliferous Trias-Jura sandstone (mostly submetamorphic greywacke) with some shales. There are small patches of younger limestone at the foot of the hills at Manawatu Gorge and along the plains on the east side together with some calcareous mudstone. The extent of these is, however, almost insignificant. The apparently recently elevated range in the vicinity of the Cook Strait is composed largely of black, slaty shales which crumble readily and run into extensive screes. The mountains, it would appear, were generally elevated in recent geological times some 600 m. with further upward warping in their middle part. Throughout there are still numerous places of uneroded tableland from which streams often plunge hundreds of metres into deep gorges. Valleys with more or less extensive river flats are not uncommon. Narrow rugged ridges as well as more gentle ones with numerous tarns are frequent, while many flat-topped summits are boggy.

Climate.

Tararua Mountains are subject to intense moisture-saturated N.W. winds. On the average, for about five days the wind blows from N.W. or N., on three days from S.E. or S. The winds are more evenly divided in July, while in January N.W. wind is more than twice as frequent as S.E. The average velocity of S.E. winds is much lower than that of N.W. The lowest mean monthly velocity at Wellington occurs in July, about 4·3 m.p.s., and the highest in October, about 6·2 m.p.s. The velocities must, of course, be much higher in the mountains. Kidson (1930) indicates on his maps that at about 1200 m. the average number of rainy days is about 200. The rainfall at this elevation exceeds 250 cm., while in the neighbourhood of 800 m. it is only 100 cm., the rainfall becoming more frequent and heavier with increasing altitude. It is fairly evenly



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distributed throughout the year. Occasionally snow falls as low down as sea-level. Above 1200 m. it persists almost continuously for about five months, from June till November. At these heights frosts occur even in the warmest parts of summer. The coldest month is July with mean sea-level temperature about 8·5° C., and the warmest, January with mean sea-level temperature about 16·7° C. The crests of the ranges are fog-bound for some 200 days a year. For two years careful records were kept, with the assistance of Mr. A. J. Hilkie, of Wellington, on the fog conditions as they could be observed from Wellington and Palmerston North. The following table shows the weather prevailing on the high crests of the central portion of the ranges during the 1932–33 season. Any day with more than 4 hours of clear weather is shown as a fine day (C), days with continuous heavy fog are marked (H), while days with intermediate conditions are marked (L). That direction of wind which prevailed during the greater part of a day is recorded as if it actually prevailed during the whole day. Calm days are credited with the wind that prevailed on days preceding them. Calm days, or days with changeable winds, however, are of too rare occurrence to affect the general accuracy of the table.

The seasons preceding and following 1932–33 indicate that the weather during the period was exceptionally fine. Thus, in 1931, there were only forty-six days with fine weather on the crests and about fifty-five in 1935. No accurate record was kept for lower ranges at either end of the mountains, but continuous observations indicate that the foggy conditions prevail there as frequently as in the higher central ranges. The southern end tends to be covered with fog more frequently during S. or S.E. winds. The same is the case with the hills north of Mount Bruce.

Man's Influence.

Extensive areas on the Tararua Mountains below 600 m. in many places have been converted into pastures or, as is the case in many places where man was not sufficiently judicious, it is laid waste, whole hillsides running into slips. Timber milling is in progress in a number of places. In others stock has full access to the otherwise untouched forest. The vegetation of these places was largely reconstructed from scattered, more or less well-preserved, remnants or else left as gaps, probably never to be filled. This particularly applies to the low range branching towards Wellington.

The vegetation, where it has not been touched by man, is remarkably free from introduced species. Almost the only places subject to invasion are river-beds where *Trifolium repens, Holcus lanatus, Dactylis glomerata, Nasturtium officinale, Agrostis* spp. are of common occurrence. Most of the other species of nearby cultivated areas also occur here. None are found in the forest except perhaps occasionally along regularly used tracks and about mountain huts. *There is only one species, Hypochaeris radicata, found above the forest line, but even this seems to be able to compete against native plants only with the help of deer.*

Weather on Northern Tararuas.

Wind Direction	N			NW			W			SW			S			SE			E			NE			Total		
Weather	C	L	H	C	L	H	C	L	H	C	L	H	C	L	H	C	L	H	C	L	H	C	L	H	C	L	H
1932																											
March					2	1										11	5	2		3		3	1	3	14	11	6
April				3		13	1									8	1	3	1						13	1	16
May			1		4	5							1			5	9	3		1	2				6	14	11
June		1		2		23		1							1		2								2	4	24
July		1	1			10								1	2	5	4	7							5	6	20
August					1	10						1		5		7	1	5				1			8	7	16
September			2	1	3	4		2		1	1		1	2	4	2		7							5	8	17
October	1	1	1	1	3	11	1	1	1				1		1	1	3	3			1				5	8	18
November				4	7	15							1	1			1	1							5	9	16
December	1			2	6	6	1	3	1					1		2	3	3	1					1	7	13	11
1933																											
January			1	4	13	6			2							4									8	14	9
February				2	5	14		1						1		1	1	4							3	7	18
Total	2	3	6	19	44	118	3	8	4	1	1	1	4	11	8	46	30	38	2	4	3	4	1	4	81	102	182
Total		11			181			15			3			23			114			9			9			365	
South Tararuas	16	12	7	22	38	104		3		2	2		22	10	49	13	5	44	2		4	5		5	80	70	215

Introduced animals exert much greater influence on the native vegetation than do plants. The Tararuas, once devoid of grazing and browsing animals, are now swarming with them. Goats are numerous in many places and are particularly abundant in the Rimutaka Ranges. Opossum are plentiful throughout. Deer and pigs infest the country, the former being especially plentiful at higher elevations, the latter at the lower. Just how much damage these animals cause is difficult to estimate in figures, but the evidence of the destruction they bring about with them is abundant everywhere. The ground cover of forest is considerably altered and even completely destroyed in many places. The trampling and consolidation of soil is to be seen everywhere. Extensive areas above the forest suffer the same fate. No less significant is the spread of stoats and weasels as well as rats and mice, which prey on bird life. As the consequence of this follows the abnormal increase of insects with disastrous effect on plants.

ECOLOGY OF THE TARARUA MOUNTAINS.

V. D. ZOTOV.

Relation to Rock.

The earliest attempt to correlate environment with the plant cover of the Tararua Mountains was made by J. Buchanan (1874). He attached particular importance to the influence of various rock formations on their plant cover. In fact, he went so far as to say that the underlying rock can be recognised by the plants growing on it. This appears to be wholly unfounded. Though a thorough study of the distribution of various rocks and plant communities may in future reveal this relationship, there is only one such case definitely known at present. This is that *Gnaphalium subrigidum* is restricted to the calcareous rocks to be found in the valleys along the foothills in the north. The distribution of all more physiognomic species is certainly perfectly explicable by climatic conditions alone.

Relation to Temperature.

In the study of the vegetation of a large area it is convenient to subdivide the latter into a number of smaller units determined by the more important environmental factors. Of these on the Tararuas, as in most other mountainous places, temperature is the most important single variable factor to consider. Next come rainfall and others associated with it. Since the Tararuas extend only some 150 km. from north to south, the latitudinal variation cannot be significant. Further, according to Kidson (1931), the isotherms with slight gradient run more or less parallel to the axis of the mountains. The altitudinal variation of ·5° C. per 100 m. over 1500 m. on the other hand is appreciable. Whatever the manner in which temperature affects the plants, the effects themselves can be readily studied, for example, the altitudinal delimination of the range of species. This in its turn gives the means of delimiting botanical belts, which may be termed *temperature belts* as distinct from those determined by other factors. On the Tararuas the belts are as shown in the table below. The principles on which modification of terminology is based are discussed by the author in "Some Correlations Between

Vegetation and Climate in New Zealand " (1938). L. Cockayne's (1928) terminology adapted especially for the Tararuas is also shown for comparison.

Cockayne's Description of Belts.	Altitude in m.	Modified Description of Belts.	
Alpine	1800	Upper (absent)	Warm subpolar
	1500	Lower	
	1200		
Subalpine: Upper		Upper	Cold temperate
Subalpine: Lower	900	Lower	
	600		
Montane		Upper	Warm temperate
Lowland	300	Lower	
	0		

Thus on the Tararuas there are three primary belts: *Warm Temperate* from sea level to 600 m., *Cold Temperate* from 600 m. to 1200 m., and *Warm Subpolar* from 1200 m. to the highest peaks. Each of these can be satisfactorily subdivided into *upper* and *lower* belts of 300 m. each. There are a number of species which extend through several belts. Many species also have an ill-defined lower range limit. The upper limit, however, in most cases is very sharp. The disappearance not only of a species, but of whole groups of them is generally complete well within 25 m. of an arbitrary limit line.

The characteristic species of the warm temperate belt are: *Beilschmiedia tawa, Hedycarya arborea, Knightia excelsa, Melicytus ramiflorus, Rhipogonum scandens, Pseudowintera axillaris, Nothopanax arboreum, Freycinetia Banksii, Clematis indivisa, Pittosporum Edgerleyi, Nothofagus truncata, N. Solandri, Mida salicifolia, Cyathodes acerosa, Metrosideros robusta, M. scandens, Astelia Solandri, Earina autumnalis, Dendrobium Cunninghamii, Uncinia uncinata, Isolepis cernua, Cyathea dealbata, Polystichum Richardi, Danthonia antarctica Cheesemanii.* All these species disappear nearly at the same altitude.

The following characteristic species of the cold temperate belt do not, as a rule, descend into the lower belt: *Pseudowintera colorata, Coprosma foetidissima, Olearia lacunosa, O. Colensoi, O. arborescens, Senecio elaeagnifolius, Dracophyllum Urvilleanum, Pittosporum rigidum, Nothopanax Colensoi, Gahnia pauciflora, Danthonia Cunninghamii, Astelia nervosa, Uncinia filiformis, Isolepis aucklandicus, Libertia pulchella, Nertera setulosa, N. dichondraefolia.*

None of the above species, nor indeed any of the other woody species of the temperate belt, with the exception of *Olearia Colensoi,*

occurs above this belt. *O. Colensoi,* however, often extends well into the lower warm subpolar belt. *Libertia pulchella* and *Uncinia filiformis* are restricted to the lower cold temperate. *Nothofagus Menziesii* is one of the most characteristic species of the cold temperate, but in fairly dry places, where plenty of light reaches the ground, it occurs in abundance. as low down as the upper warm temperate. *Nothofagus fusca* ranges generally from lower cold temperate to upper warm temperate. A few species including *Weinmannia racemosa, Coprosma australis, Aristotelia racemosa, Rubus cissoides, Dacrydium cupressinum, Fuchsia excorticata* range from the lower cold temperate to the sea-level.

Of the higher belts only the lower warm subpolar is represented on the Tararuas. The following species are characteristic of this belt: *Dracophyllum rosmarinifolium, Senecio Bidwillii, Hebe Astoni, Raoulia rubra, R. grandiflora, Phyllachne Colensoi, Celmisia hieracifolia, Danthonia flavescens, D. ——, Astelia Cockaynei, Celmisia spectabilis, Anisotome dissecta,* and *A. aromatica* are often the dominant species, particularly the first three. *Aciphylla Colensoi conspicua, Ranunculus geraniifolius,* and many others are plentiful.

Relation to Sunshine.

The temperature belts as just described must be distinguished from vegetational formations such as scrub and forest. The latter may or may not coincide with the former and since they are often characterised by a single dominant species, they may depend on any of the numerous controlling environmental factors. The dominant species of the scrub formation on the Tararuas is usually *Olearia Colensoi,* while of the forest of the higher altitudes it is almost exclusively *Nothofagus Menziesii.* Since *O. Colensoi* penetrates far down into the forest, it is obvious that this timber line depends entirely on the presence or absence of *N. Menziesii.*

On the Tararuas, particularly on their western side, the timber line is very irregular, varying from 1200 m. to 500 m. The lowest point to which the timber line drops occurs in the neighbourhood of Baber's Saddle, about 30 km. south of the Manawatu Gorge. Here the scrub formation, which includes some *Weinmannia racemosa, Podocarpus Hallii,* and *Phyllocladus alpinus* reduced to scrubby state, is to be found alongside the forest of warm temperate belt. It may be noted that the variation in altitude of the timber line is in no way connected with altitudinal range of the temperature belts, which remain constant throughout, with the exception perhaps that they appear to be a little higher in the northern portion of the ranges.

The incidence of heavy fog on the crests of the mountains was discussed in the introductory part. It remains to point out that the lower level of the fog is observed to coincide very closely with the timber line. This indicates that the intensity of illumination is reduced by the fog for more than half the time to much below the requirements of tree species, particularly *Nothofagus Menziesii,* which could enable them to compete successfully against scrub. Measurements with a photoelectric cell show that the direct mid-day sunshine is reduced by about 200 times immediately underneath cloud ceiling, while in the fog it may be reduced by 1,000 times

and more. Examination of the uppermost branches of *N. Menziesii* taken from various altitudes of lowered timber line in sheltered places shows annual radial increment of about ·2 mm. for the first three or four years. In similar specimens taken from the timber line at maximum altitude (1200 m.), where sunshine is much more abundant, the increment is about 1 mm. At the same time the trees at this altitude show every indication of having reached the coldest level at which they can compete satisfactorily. They are of low stature, hardly 3 m. high or much lower, with flat crowns and long spreading boughs. Examples of these are commonly to be seen in the central and eastern ranges, where they are bordered by the meadows of the higher belt. The timber line is quite different where it is more or less appreciably lowered. The line is very broken, odd patches of trees jutting out frequently well above the general level and occasionally quite separating from the main body of the forest. The trees themselves are, as a rule, perfectly formed, standing with their crowns two to three times above the scrub species, which are here some 3 or 4 m. tall.

The regeneration of forest at timber line at its maximum altitude is a continuous process. There is plenty of light reaching the floor. When the old trees die, seedlings quickly take their place. The timber line there is thus fairly fixed. On the other hand, the lowered timber line is always slowly advancing upwards until it is cut off from the rear and the process begins anew. Under the scrub, within a few metres of the forest, tree seedlings appear in great numbers, some of which survive the competition for light. Seedlings are also numerous for a few metres within the forest, but farther back they seldom survive the dense shade. The scrub species, particularly *Olearia Colensoi,* are much more shade-tolerant and can exist where tree seedlings perish. The result of this is that when the old trees begin to die their place is quickly occupied by scrub and the new timber line is formed below. Occasionally a patch of scrub may be adversely affected in some way, as, for example, by severe attack of a certain moth caterpillar on *O. Colensoi; N. Menziesii* is then able to establish quickly in a cleared space. The lowered timber line is thus continually fluctuating under the severe competition for light.

Relation to Rainfall.

Detailed information on the distribution of rainfall is not available, but the variation in the amount of it can be deduced, satisfactorily for the present purpose, from the study of the effects produced by it. The density of the vegetation in general, the abundance of epiphytes and bryophytes, all serve as useful indicators, while the presence or absence of a number of characteristic species indicates unmistakably the relative amount of precipitation. The Tararuas are not high enough to cause the rainfall to vary much from one place to another. In general the western slopes everywhere receive a somewhat higher precipitation than the eastern. The difference is greatest where the two sides are separated by greater distance and higher intervening ranges. Thus, in the central Tararuas, the general aspect of the warm temperate belt on the

eastern side has little resemblance to that of the same belt on the western. However, the difference practically disappears within the lower half of the lower cold temperate belt. Higher still the conditions are not strictly comparable owing to the difference in illumination. The rainfall here, in all probability, exceeds 250 cm. per annum (Kidson, 1930). February is probably the driest month, when even the wettest ground of the warm subpolar may be parched for a few days at a time.

The distribution of the species of *Nothofagus* is of special interest. First of all the absence of *N. cliffortioides* is noteworthy. This species inhabits fairly dry localities in the cold temperate belt, but as such are absent from the Tararuas, so is the species. Its place for the greater part is occupied by *N. Menziesii,* which normally inhabits the wet cold temperate belt. North of Mount Dundas, however, where a peculiar combination of low rainfall and heavy fog prevail, both species are absent, and their place to some extent is taken by *Dacrydium biforme. N. fusca* tolerates a fairly wide range of precipitation and is widely distributed. It ranges mainly throughout the lower cold and upper warm temperate belt, but is practically absent from the latter on the western side, being ousted by *Dacrydium cupressinum* and *Metrosideros robusta* forest. Both *N. truncata* and *N. Solandri,* especially the latter, occupy much the driest portions of the mountains. They extend through the warm temperate belt south of Mount Alpha.

There are four distinguishable rainfall areas on the Tararuas, characterised by their own floristic elements.

The *Southern Tararua Area,* consisting of the Hutt River Basin and the Rimutaka Ranges, is the driest of the four areas. It is effectively screened by the range (now for the most part devoid of primitive vegetation) rising to some 600 m. and running along the coast from Wellington to Mount Kapakapanui. The northern boundary extends approximately from Mount Wainui over Mount Omega to Mount Reeves. The area is characterised by the presence of the following species: *Nothofagus truncata, N. Solandri, Danthonia antarctica Cheesemanii, Raoulia glabra, Leucopogon fasciculatus, Cyathodes acerosa, Leptospermum scoparium, L. ericoides, Helichrysum glomeratum.*

The *Northern Tararua Area* has its southern boundary ill-defined. The latter runs approximately over Mount Waiopehu, Mount Dundas, and Mount Bruce. The mountains north of this line lie in the rain-shadow of Mount Egmont and considerably inland. Being for the most part low, they intercept comparatively little rain. The characteristic species are: *Dacrydium biforme, Phyllocladus alpinus, Veronica catarractae, Elatostema rugosa.*

The *Western* and *Eastern Tararua Areas* occupy the central portion of the mountains. The difference in rainfall between the two areas is already indicated. In addition, in the Eastern Area, the sunshine is much more abundant at higher altitudes than in the Western, and hence there is a greater luxuriance of vegetation and more prolific flowering. It is convenient therefore to draw the boundary between the two areas approximately in a straight line over Mount Arête and Mount Omega.

The Western Tararua Area is characterised mainly by the abundance of epiphytes and luxuriance of undergrowth particularly in the warm temperate. The entanglements of *Rhipogonum scandens* and *Freycinetia Banksii* form an outstanding feature. *Beilschmiedia tawa, Gleichenia Cunninghamii* are abundant, while the almost complete absence of *Veronica catarractae* and *Elatostema rugosa* as well as *Nothofagus truncata, N. Solandri, Cyathodes acerosa,* and *Leucopogon fasciculatus* is noteworthy.

In the *Eastern Tararua Area* the last four species are more or less characteristic. The epiphytes are not nearly so profuse as in the Western Area, the undergrowth is much thinner, and the ground is littered with dead leaves. The forest floor generally is remarkably free of fallen logs. Apparently the decay proceeds here very rapidly as compared with the Western Area. There the ground is strewn with dead logs often as large as 2 m. in diameter. They are thickly covered with bryophytes, filmy ferns, and other plants which quickly form a thick layer of permanently wet humus, the latter acting as a blanket, preventing free circulation of air and slowing down the processes of decay. In the upper cold temperate belt of the Eastern Area the abundance of pendulous *Osnea* sp., which is practically absent elsewhere, is a striking feature.

Relation to Humidity.

Humidity in general is more or less directly connected with precipitation and fog formation. These aspects of it have already been discussed sufficiently for the present. Humidity due to evaporation is of some slight interest. Vegetation is always much more luxuriant along river banks and other masses of water particularly in this Eastern Area. Even in the cold temperate belt, where precipitation is high, along the smallest water-courses the bryophyte flora is especially rich. The pendulous mosses and liverworts such as *Weymouthia* and *Lapicolea* abound.

Of greater interest, however, is the lowering of humidity brought about by wind. This agent, by removing the comparatively saturated atmosphere from the immediate neighbourhood of plants, causes steepening of the saturation gradient in the vicinity of the transpiring surfaces, thus greatly increasing the rate of transpiration. The result of this is an appreciable reduction in leaf-surface, and, as a consequence, decreased rate of assimilation, and, hence, growth. In the most adverse conditions such as exist on Mount Omega, 1100 m., which is subject to severe dry north-westerly winds descending from the main divide, the leaves of *Nothofagus Menziesii* are reduced to half the area of those growing in similar but sheltered places, such as certain places on the timber line, 1200 m., on Mount Alpha. The average length of leaves in the two places is about 7 mm. and 10 mm. respectively. The average rate of radial increment per annum of the uppermost branches is about ·5 mm. and 1 mm. in the two respective places. Leaves of *Olearia Colensoi, Nothopanax Colensoi,* and *Pimelea longifolia* taken from the scrub formation from windward and leeward sides of several ridges, where the mechanical force of the wind is not evident, showed even greater variation. Although the respective places were only a few metres apart and separated

by the crest of the ridge only 2 or 3 metres above them, the average sizes of leaves of all species on the leeward side was found to be about four times greater in area than of those on the windward. The number of stomata in all cases was found to be the same in leaves from either side, but the venation was much denser in the leaves from the windward side. The annual rings were found to be twice as thick and internodes twice as long in the upper branches from the leeward side as in those from the opposite side.

The plants thus weakened are often unable to compete successfully against the invasion of communities otherwise to be found at higher levels. This type of modification of the vegetation is to be observed along many prominent ridges. Thus on the ridge leading to Mount Dennan scrub is invaded by *Astelia Cockaynei,* which is generally associated with *Phormium Colensoi.* This in turn is invaded by *Danthonia antarctica flavescens.* The latter jordanon grows luxuriantly up to the highest peaks, 1500 m., but on exposed slopes it is generally replaced at about 1300 m. by a still more xerophytic *D. a.* var. (undescribed).

Relation to Wind Force.

The mechanical force of wind becomes appreciable on the higher ridges and particularly about flat tops and in saddles. The north-westerly wind often attains here a velocity against which it is almost impossible to proceed even by crawling. The surface in such places is generally bare of all but ground-hugging plants such as cushions of *Phyllachne Colensoi, Raoulia rubra,* and rosettes of *Anisotome aromatica* and *Oreomyrrhis andicola.* If the wind is more restricted in its direction, numerous narrow channels are worn in the ground with intervening strips of *Danthonia antarctica* and, perhaps, some other herbs and shrubs.

An interesting effect can be seen on Mount. Omega, 1100 m. It is about the only place on the Tararuas where *Nothofagus Menziesii* is subjected to the direct force of extremely severe north-westerly gales descending from the main divide past Mount Hector. The wind is particularly concentrated at the broad top, which is swept practically clear of all vegetation, but behind every protruding rock *N. Menziesii* together with *Dracophyllum Urvilleanum* is to be found. The trees with tortuous and quite prostrate trunks stand not more than 50–100 cm. high and have perfectly streamlined "crowns." The greatest thickness of trunks observed was 15 cm. in diameter, but this varies greatly because of irregular growth. Branches 5 cm. in diameter were cut from three different trees. Their age proved to be about 300 years each. Accurate counting of annual rings was impossible owing to their extremely small size, often less than 2 cells thick, and a high probability that many rings were entirely missing. It is noteworthy that *Olearia Colensoi* is plentiful on the leeward side, but is practically absent for some distance down on the windward side, its place being taken by *Dracophyllum Urvilleanum.* The latter is always more plentiful than the former in the drier places, so that it is probable the phenomenon, as far as these two species are concerned, is really brought about by the drying effect of the wind. However, the foliage of *Dracophyllum* is undoubtedly more suited to resist the force of the wind than that of *Olearia.*

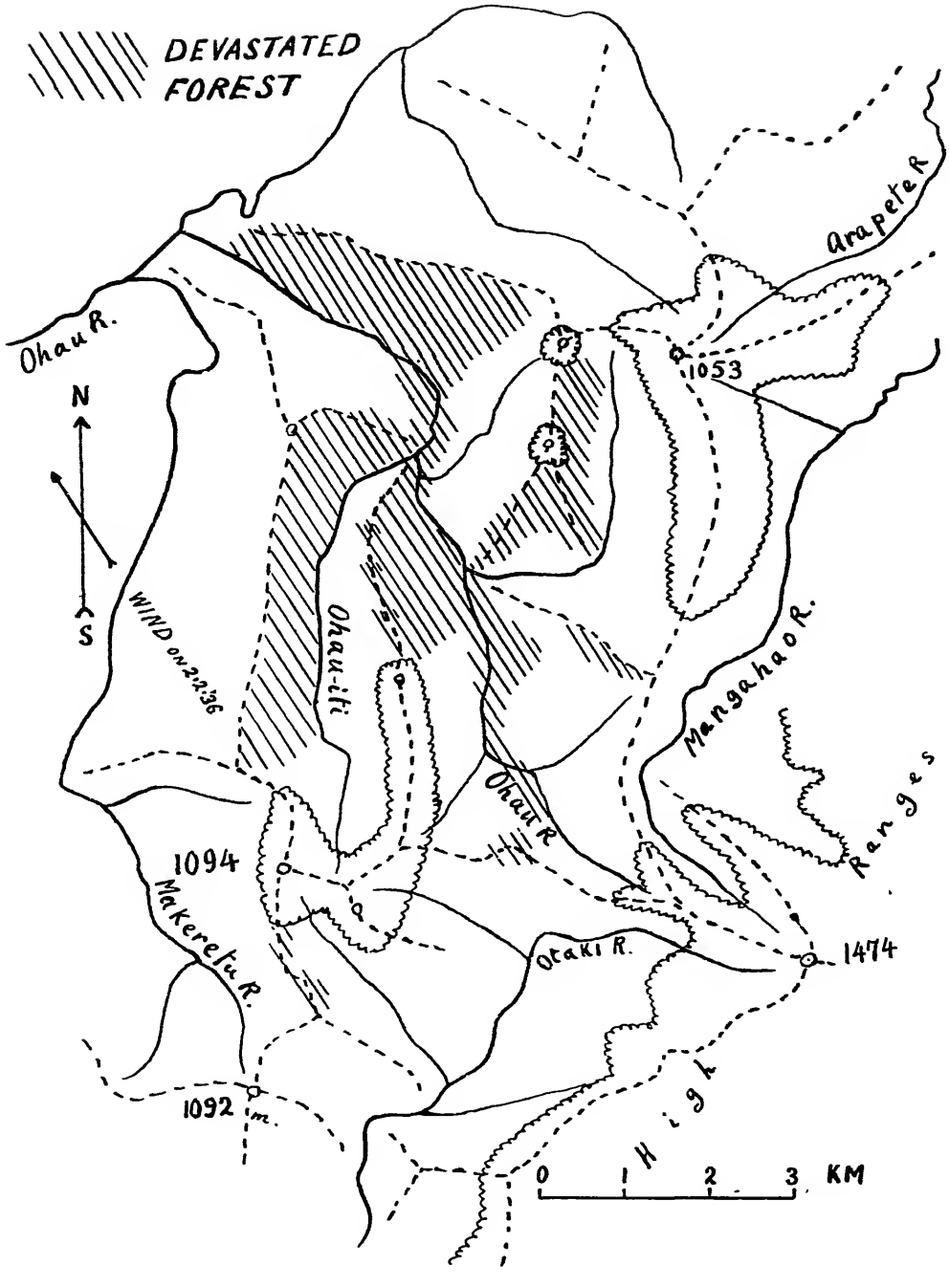
Practically everywhere at this maximum altitude for the timber line the forest roof has a peculiar levelled surface. This appears to be due to low temperatures and high insolation during clear weather causing transverse geotropism, rather than any direct or indirect action of wind. At least there does not seem to be any evidence to support the latter assumption.

There are three places observed in the cold temperate belt where forest is subjected to particularly severe descending north-westerly wind. These are the eastern slopes of Mount Baldy, just south of Mount Mitre, Mount Holdsworth, and Mount Matthews. The trees there never reach maturity, their diameters seldom exceeding 20 cm. The floor is strewn with decaying and still living overturned trees. During a high wind the trees rock violently, lifting boulders of considerable size upon their roots and dropping them down again with a deafening clatter. Uprooted trees up to 2 m. in diameter are not uncommon on the Tararuas everywhere, but these are, as a rule, either over-sized or over-aged trees.

As has been pointed out, the average velocity of the south-easterly wind is very low compared with that of the north-westerly, yet, on rare occasions, perhaps less often than once in a lifetime, it may attain great velocity. "During the night of the 1st and the morning of the 2nd (February, 1936) a deep cyclone, which had originated some days before as a tropical cyclone to the north-west of the New Hebrides, rapidly increased its spread of movement, travelled down the western side of the Auckland Peninsula, and thence across the centre of the North Island and away in a south-easterly direction." (Dominion Meteorological Office, 1936.) On the Tararuas the south-easterly wind began to be felt about 8 a.m. on February 2 and it gained its maximum force between 10 a.m. and mid-day. In those two hours whole hillsides of forest were completely levelled. The main destruction occurred in the foothills in the Western Area and the south-western portion of the Northern Area. The wind swept downwards from over the main ranges, concentrating its force upon the eastern slopes and along the valleys. Small trees and forest giants suffered alike. Some of the wrenched-out roots stood on edge some 8 m. high and up to 20 m. in spread, leaving hollows in the ground up to 2 m. deep. Of mature trees *Dacrydium cupressinum* appears to be the only one which was capable of withstanding the blast. Although badly battered, there are many trees of this species to be seen standing alone amidst destruction. They owe their preservation partly, no doubt, to their superior root development, but, probably, largely to the pendulous nature of their branches, which offered relatively small resistance to the wind. Numerous trunks of *Metrosideros robusta* also stand, but they are mostly stripped of their crowns. A portion of the affected area is shown on the accompanying sketch-map.

Relation to Snow-fall.

Snow-fall, like wind, possesses appreciable mechanical force. A striking instance occurred in the Eastern Area. Heavy snow fell during the 3rd to 6th August, 1932. It was especially calm on the last day of the fall. Consequently a large volume of snow was



Sketch map to show some of the area affected by the storm of 2/2/36.

To face page 270.

caught by the branches, and its enormous weight snapped great boughs and occasionally completely stripped large trees of their crowns, forest in the warm temperate belt suffering particularly severely. This effect of snow, although on a smaller scale, is quite common in the cold temperate belt in fairly sheltered localities. Thus, about Mount Alpha Hut trees stand well spaced, often with almost bare trunks except for the small surmounting crowns. The stripping of branches, which does not affect all trees in the same year, accounts for the very erratic thickening of annual rings.

In the subpolar belt as much as 100 to 150 cm. of snow may fall at one time, and a somewhat greater thickness accumulates during winter months. The weight of snow, especially on the steeper slopes, has the effect of rolling down the vegetation. Further, where it accumulates, it lasts into the late spring, considerably shortening the growing season. Under it, formations similar to those of boggy ground occur. Particularly characteristic species are: *Astelia linearis, Coprosma repens, Caltha novae-zeelandiae.*

Relation to Frost.

Occurrence of frost has a different ecological effect from that of variation of temperature in general. Its effect is particularly noticeable on the flowering shoots of many subpolar belt species, which are not infrequently killed. *Anisotome dissecta* and *Chrysobactron Hookeri* suffer heavily in this way. The effect on the distribution of *Ranunculus insignis* is of interest. The latter is never found on eastern or northern aspects except in deep ravines. It appears that the rapid thawing after a frost is injurious to this plant. Most plants, however, appear to be quite hardy to the frosts affecting their habitats.

Relation to Slope and Soil.

The aspect of the slope in the forest, at any rate, does not appear to be of much consequence, provided climatic factors have been considered separately. A much greater effect on vegetation is brought about by the degree of slope, as this is closely associated with soil development and moisture content. As the slope becomes steep trees become unable to obtain sufficiently strong root-hold. Shrubs persist in crevices even on almost vertical slopes provided the moisture supply is adequate. The steep slopes in the subpolar belt are generally well supplied with percolating moisture. Their soil is usually thin, but densely covered by the so-called "rock garden." The following usually abound in such places: *Anisotome dissecta, Leucogenes leontopodium, Celmisia spectabilis, Ranunculus insignis.* On the less inclined slopes the soil is much thicker and is covered by meadows of *Danthonia antarctica,* which is usually associated with *Astelia Cockaynei* in somewhat steeper places. In many places steep slopes run into screes which attain extensive proportions on the eastern side of Mount Matthews ridge. Plants establish themselves with difficulty in such places and often their associations do not reach the climax before the next soil movement begins. On some slopes of Mount Matthews it never seems to end, even under forest.

On more or less flat surfaces and around springs the soil is often almost permanently wet and is hummocky and spongy. The vegetation here is usually very dense but not more than 10 cm. tall. This peculiarity is apparently due to deficiency of soil air. At any rate, the soil is quite warm, indeed, much warmer in the direct sunshine than under the adjoining tussocks, and it does not appear to be stagnant, water in the pools being as fit for drinking as in the streams issuing from them. All plants inhabiting such places send roots out more than 10 cm. down, and a large portion of the species is composed of liverworts and mosses.

There are few places which can be termed bogs. The outstanding examples of these are known near the top of Mount Omega and near the top of Mount Oriwa (900 m.), the Oriwa Lake-Hollow, about 3 km. south of Mount Waiopehu. On Mount Omega (1100 m.) this was once a *Dracophyllum Urvilleanum* association in a *Sphagnum* bog of about one hectare or so in extent. It is now very much altered by the continual trampling of deer. Oriwa Lake-Hollow is in reality but a slightly depressed elongated area of a few hectares in extent, surrounded by *Nothofagus Menziesii* forest. It appears to have once been a continuous *Sphagnum* bog with but few spermatophytes in its association. Now, however, about half of it is drained (there is an outlet) and is occupied by scanty growth of *Agrostis Dyeri, Uncinia compacta, Epilobium pedunculare, Gnaphalium Mackayi* and a few others together with *Celmisia gracilenta.* The latter species is known to occur in abundance only in this place and a somewhat similar one on Mount Kaiparoro, otherwise it is a rare species occurring along the eastern side. Of shrubby species only *Pittosporum rigidum* and *Coprosma parviflora* occur in the drained area as stunted shrubs.

Relation to Local Climatic Variations.

There are on the Tararuas a number of small areas where unusual combinations of climatic factors occur. These result in peculiar local modifications of vegetation, often very unlike that of the larger areas in which they are situated.

The Manawatu Gorge, and also to some extent other larger gorges in the Northern area, owing to the presence of a large body of water, is comparatively humid and its mean temperature near water is appreciably lower than in the surrounding country. Further, although the absolute amount of illumination is much smaller in the gorge, the relative amount available to shrubs and smaller plants is much larger than it would be under forest conditions. Here, therefore, a number of heliophytes are found on the steep rocky faces, e.g., *Myoporum laetum, Dodonaea viscosa, Edwardsia tetraptera, Carmichaelia odorata, C. filiformis* (?), *Phormium Colensoi.* The usually epiphytic plants, *Astelia Solandri, Cyclophorus serpens, Earina autumnalis,* festoon higher rocks. A specially interesting association occurs on rocks in the Manawatu Gorge just above the flood level. This consists mainly of *Danthonia setacea setifolia* (probably), which extends generally through the gorges of Northern Area, *Festuca multinodis* var., both of the latter apparently locally endemic. *Cladium Sinclairii* also occurs there but nowhere else on the Tararuas. The occurrence of *Rubus squarrosus* on the drier rocks

is of interest, while in the forest extending but little further south are to be found *Adiantum formosum, Arthropteris tenella* and *Oplismenus undulatifolius.*

Cape Turakirae and the mouth of Muku-muku River have a somewhat similar climate to that of Manawatu Gorge, but being completely isolated from the latter they have their peculiar floristic element. On the cliffs here, too, *Phormium Colensoi* is prominent. *Festuca multinodis* var. is abundant. *Danthonia setacea* is absent, but its place at Muku-muku River is taken by *D. bromoides. Senecio Greyi* is also abundant here, as well as *Muehlenbeckia axillaris* and some *M. Astoni. Trisetum Youngii saxeticolum* seems to be endemic to the coastal slips of this locality. *Coprosma retusa, Myoporum laetum* are prominent on the cliffs, while *Corynocarpus laevigatus* is generally abundant on the old fans.

Paekakariki hill cliffs are characterised by the presence in quantity of *Coprosma retusa, Muehlenbeckia axillaris, Myoporum laetum* with the addition of some characteristic subtropic element, which extends up the hillsides for some 300 m. It must be noted that the cold south-easterly wind descending strongly from over the range becomes appreciably warm here, and this raises considerably the mean temperature. The characteristic species which are not to be found elsewhere on the Tararuas are the following:—*Disoxylum spectabile, Melicope ternata, Mida Cunninghamii* and *Carmichaelia australis.*

Mangatainoka and Upper Ruamahanga River basins have wide valley floors and fairly gentle valley slopes. The rainfall here is very low, especially in the Ruamahanga basin. Consequently the forest is very light and a fair amount of light reaches the floor. Whether there are other modifying factors involved is not certain. However, a number of species which as a rule keep above 600 m. descend here to almost 400 m. Especially noteworthy are *Blechnum capense minor, Libertia pulchella* and *Pseudowintera colorata.* In the Ruamahanga basin on the northern slopes between 400 and 500 m. the undergrowth under *Nothofagus fusca* is most peculiar in the assemblage of species. Here *Hebe salicifolia, Leptospermum ericoides, Olearia arborescens, O. Colensoi, Senecio elaeangnifolius, Coprosma foetidissima, C. rotundifolia, C. Colensoi, C. Banksii, C. rhamnoides, C. robusta, Hoheria sexstylosa, Melicytus lanceolatus, Schefflera digitata, Nothopanax arboreum, Brachyglottis repanda, Coriaria arborea, Gaultheria antipoda, G. rupestris, Suttonia salicina, S. australis,* and *Astelia nervosa,* representing wet and dry areas, and warm and cold belts, all grow together. Of especial interest, however, is the occurrence here of *Coprosma tenuifolia,* which does not occur elsewhere on the Tararuas.

Above the Ruamahanga River on the spur leading to Mount Pukeroa there is an extensive and almost pure association of *Olearia Colensoi* which extends vertically from mixed scrub at about 850 m. to 1200 m. The climate here is also noticeably dry and from various observations appears to be characterised by frequent dense but fine fog.

A little further north of this, on the long spur leading from Mangatainoka River to Mount Ruapai conditions appear to be even drier. Here at about the same altitudes *O. Colensoi* is completely absent and extensive areas are occupied by a dense association of *Danthonia setacea setifolia,* an association not to be seen anywhere else on the Tararuas.

The Park and Waiohine-iti are two parallel glaciated valleys in the central Tararuas. Their floors in the upper reaches are at about 900 m. altitude and are guarded on all sides by ridges well over 1200 m. with steep almost precipitous slopes. The wind in the valleys, judging by the vegetation, never assumes high velocity, and always blows up the valleys irrespective of the wind above it. It appears that the drying effect of the eddy currents must be appreciable. Further, the rainfall is probably considerably reduced by the high ridges. The steepness of the slopes and the porous nature of the soil of the valley floors must add to the general dryness of this local climate. At any rate, the total effect is to stop the forest abruptly on the valley sides, as well as on their floors, some distance below their heads. Scrub advances little further, tussock covering the remaining portions. That the conditions there must be rather dry is evidenced by the occurrence of fires, which, started accidentally by deer-stalkers, run through the tussock. Such fires occur only on the eastern side of the ranges, which is comparatively dry. In the Waiohine-iti Valley *Deschampsia tenella, Agrostis alpina, Brachycome Sinclairii* are common but are rare elsewhere. In the Park Valley *Hypolepis millefolium* is plentiful on valley slopes among tussock. On the valley floor *Danthonia setacea setifolia, Blechnum penna-marina* (the only record from Tararuas), *Ranunculus acaulis* are common. *Gnaphalium trinerve* is characteristic among the rocks along the river-bed. Of the grass species *Danthonia antarctica* (the variety of high ranges) is characteristic of both valley floors. It grows luxuriantly, reaching 100–150 cm. in height as compared with its usual stature of 20–30 cm. on the high wind-swept ridges.

In the Wairongomai River basin the lower warm temperate belt exhibits several odd features. The dominant tree here is *Podocarpus spicatus,* which is very rare or absent elsewhere. Amongst it, especially along the foot of the slopes, there are patches of *Laurelia novaezealandiae. Knightia excelsa, Beilschmiedia tawa, Macropiper excelsa, Rhipogonum scandens, Leucopogon fasciculatus, Coprosma rhamnoides, C. rotundifolia* and patches of *Leptospermum ericoides* and *L. scoparium* on young river flats are also common. Except for *Podocarpus spicatus* the general aspect of the vegetation here very strongly resembles that of the Northern Areas.

The occurrence of small but almost pure stands of *Phyllocladus alpinus* at about 700 m. on a ridge leading to Mount Ngapuketarua and on Renata are noteworthy, especially the latter, which is an entirely isolated colony. Similar stands of small trees of *Dracophyllum Urvilleanum* occur at about 800 m. on the ridges leading to Mount Ruapai and some of those to Mount Matthews.

On Mount Macintosh exists a very peculiar association of *Schoenus pauciflorus* and *Olearia Colensoi,* the latter being not more

than 15 cm. high (200 cm. is its usual stature). The turf thus formed is very dense and spongy underfoot. At the time of visit (end of December, 1930) the ground was saturated with water although the slopes are quite steep and there was that day only a light fog. It may be observed that this place is especially subject to heavy fogs and thus there is probably severe deficiency in both sunshine and soil oxygen supply, resulting in extreme depauperation of *O. Colensoi.*

Interrelation of Plants.

So far only the general relation of plants to the climate has been discussed. Plants, however, modify greatly climatic conditions in their immediate neighbourhood, and this is especially pronounced within such formations as, e.g., tall forest.

Metrosideros robusta, the common rata, furnishes an outstanding example. It is a tall forest tree, but its massive trunk is not a true stem but a single or a number of more or less fused roots. It is a light-demanding large bushy " shrub " which cannot exist on the forest floor (at least not on the Tararuas). Instead it commences its life as an epiphyte high up in the forks of the tallest trees. It then sends to the ground one or more slender roots, which finally become established in the soil and function as ordinary stems. These stems often surround the foster tree at its base and in the early stages also clasp the trunk of the supporting tree more or less permanently by lateral roots. This fact, together with that of rata surviving long after the death of its foster tree, led Kirk (1872) to believe that the former strangles the latter. On the Tararuas the foster tree is usually rimu, *Dacrydium cupressinum,* and the dead trunks of these are commonly to be seen. The author, however, was never able to detect any evidence of strangulation. The explanation of the death of the rimu is to be sought in its failure to compete successfully for light. Rimu, like rata, is also a strong light-demanding plant, as is evidenced by its habit of growth. Once, however, its crown is overtopped by the epiphyte it is doomed to die.

Rata is found in abundance in the wet Western Area and is practically absent in the dry Eastern Area. This is in keeping with the profusion of epiphytes in the former and their paucity in the latter. In the forks of tall trees in the Eastern Area the conditions are generally far too dry for any large epiphytes, such as *Astelia Solandri* or *M. robusta,* to become established.

A few trees with true stems often behave, particularly in the Western Area, in a similar manner to rata. Among these *Nothopanax aboreum, Melicytus ramiflorus, Weinmannia racemosa* are conspicuous. They not infrequently begin their life 8 to 10 m. above ground but finally establish their roots in the ground. In this area large numbers of ferns, many shrubs, and a good few trees in their juvenile stage exist among true epiphytes well above ground. This is rendered possible through a dense growth of true epiphytes such as many filmy ferns, bryophytes and astelias. Further, many species are either driven out of existence in this area by the dense shade produced by more vigorous plants, or are driven up tall trees to assume an almost epiphytic habit. *Senecio Kirkii* is a noteworthy example of the latter group in the warm temperate belt. Under the entangle-

ments of *Rhipogonum scandens,* due, no doubt, to the dense shade produced by it, the ground is often practically bare of all other growth. Here *Freycinetia Banksii* is usually a lofty climber, but where plenty of light reaches the ground, as on some ridges and steep slopes, it frequently spreads over large areas of ground almost to the complete exclusion of all small plants and even shrubs.

Nothofagus Menziesii is usually a fairly deep-rooting tree, but in many places, especially in the upper cold temperate belt, its root system is to a large extent on the surface or even elevated up to some 50 cm. above ground. This is brought about by a dense unbroken mat usually of *Hymenophyllum multifidum* spreading over them and holding a permanent supply of moisture.

Interrelation of species is best observed in the succession and regeneration of the vegetation. Only brief notes can be made on these points at present. Regeneration of forests is more or less a continuous process depending on the amount of light falling on the forest floor. The soil is full of seed, and seedlings or what pass for such, 20 to 30 years old trees, begin to grow rapidly when opportunity arises. It is interesting to note that an examination of annual rings of *Nothofagus Menziesii* trunks of varying diameters up to 20 cm. at 1 m. from the ground proves them to be all of the same age in any one place.

In the warm temperate belt in the Southern Area in many places vegetation is unstable owing to continuous creeping down of screes which are very extensive, particularly in the Muku-muku basin. *Nothofagus* forest appears to be the climax association but this on the steeper slopes seldom develops. There are many places where screes have apparently resumed active movement comparatively recently. Their surfaces are strewn with dead logs.

When the movement slows down *Raoulia tenuicaulis, Danthonia semiannularis, Poa anceps, Acaena sanguisorbae, Paesia scaberula, Blechnum procerum, B. fluviatile, Epilobium* spp. and some other herbaceous plants arrive among the first colonisers. These are followed by *Leptospermum ericoides* generally in association with *Cassinia leptophylla, Cyathodes acerosa, Leucopogon fasciculatus, Helichrysum glomeratum, Hebe salicifolia, Rubus cissoides, Brachyglottis repanda, Cyathea Smithii,* and others. In the succeeding stage *Melicytus ramiflorus, Alectryon excelsum, Weinmannia racemosa, Beilschmiedia tawa, Hedycarya arborea, Metrosideros* spp., *Freycinetia Banksii,* and *Rhipogonum scandens* become established and often form a fairly stable association. Various transitional stages are quite commonly met with. Occasionally old trees of *Leptospermum ericoides* with trunks up to 35 cm. in diameter are encountered in mature associations subsequent to that of *Leptospermum.*

Somewhat similar successions take place in other parts of the warm temperate belt on the Tararuas, but *Pteridium aquilinum* often takes a prominent part in the initial colonisation and is usually succeeded with difficulty by other plants. The screes, however, in the Eastern Area are not very frequent, while in the Northern and Western they are almost unknown. The rock in these screes weathers almost directly into clay and the place of the screes is taken by

frequent landslips. Usually landslips are quickly occupied by *Blechnum procerum, Microlaena avenacea, Brachyglottis repanda.* These are rapidly followed by most common species of undergrowth.

In the cold temperate belt throughout, regeneration on the landslips is very similar to that in the warm temperate in the Western Area, but *Hebe salicifolia* is generally the first to establish quickly a dense association.

Regeneration after fire, which is not infrequent in the warm temperate belt, particularly on the eastern side, whether accidental or purposeful, even after sowing down of pasture grasses, provided man does not interfere further energetically with natural processes, quickly brings the land under forest back to its original state. Here *Pteridium aquilinum, Pteris incisa, Blechnum fluviatile, Acaena sanguisorbae, Erechtites prenanthoides, Brachyglottis repanda,* with perhaps some *Leptospermum scoparium* and *Cassinia leptophylla* rapidly become established. These are followed by *Blechnum discolor, Hebe salicifolia, Geniostoma ligustrifolium, Rubus cissoides, Schefflera digitata, Coprosma australis,* and *Weinmannia racemosa.* On the western side the whole is often dominated by *Cyathea Smithii* with some *C. dealbata.* Successions then follow in the usual manner. In the drier regions *Nothofagus* always forms the climax association. In the wetter, the climax association is dominated by *Metrosideros robusta,* which supplants more or less completely *Dacrydium cupressinum. Beilschmiedia tawa* often forms a distinct association, which, however, in most cases appears to be an intermediate stage in succession, preceding *D. cupressinum.*

In the cold temperate belt fires occur almost exclusively, and then only rarely, in the Eastern Area. A conspicuous feature of regeneration here is the almost immediate growth of *Nothofagus* and *Weinmannia,* or only the former, resulting in practically pure stands which for a long time afterwards are almost free from undergrowth.

In the warm subpolar belt fires are also restricted to the eastern side. The burns, as they are to be seen on Mount Mitre and in Park Valley, are quickly occupied by *Poa imbecilla* and *Agrostis Dyeri. Leucogenes leontopodium* and *Ranunculus geraniifolius* appear in quantity. Most of the perennial plants revive, as also do the tussocks of *Danthonia antarctica,* although more slowly.

Relation to Native Fauna.

So far as it affects the vegetation of the mountains the native fauna consists of Insecta, Arachnidia and Avis. Extremely little is known of the influence exerted by these on plants. Scale insects are numerous. Gall-forming insects and spiders occur on a number of small-leaved species of *Coprosma,* on *Shawia paniculata, Nothofagus fusca, Hoheria sexstylosa, Carmichaelia odorata,* and *C. flagelliformis.* Leaf-mining and chewing insects attack a number of species. Especially important among these is the larva of a moth which feeds on young leaves and buds of *Olearia Colensoi.* It seems to make its appearance in large numbers at a few years' interval, killing out vast areas of scrub. The old dead shrubs among later generations persist for many years before they decay and are to be seen in many places, having the appearance of having been burned. The last

appearance of the massed attack was first observed in 1933. Large areas of *Olearia* scrub are already destroyed and the insects are still (1936) spreading. Many scrub species are also subject to attack by various stem-boring insects. Besides their destructive activity many insects and particularly Lepidoptera and Diptera are of course important agents of pollination.

Birds exert their influence mainly in two directions: dissemination of species and destruction of insects. They are fairly plentiful in the forest, the following being common:—Tui *(Prosthemadera novae-seelandiae),* bellbird *(Anthornis melanura), kaka (Nestor occidentalis),* pigeon *(Hemiphaga novae-seelandiae),* owl *(Ninox novae-seelandiae),* grey warbler *(Pseudogerygone igata),* fantail *(Rhipidura flabellifera,)* rifleman *(Acanthisitta chloris),* tomtit *(Petroica toitoi),* N.Z. pipit (particularly on tussock) *(Anthus novae-seelandiae).* Fairly common: Whitehead *(Mohoua albicilla),* long-tailed cuckoo *(Urodynamis taitensis),* shining cuckoo *(Lamprococcyx lucidis).*

Relation to Man and His Agents of Destruction.

There is no evidence of activities of the Maori in the Tararua Mountains. Since the advent of the Pakeha, however, man's influence, direct and indirect, has wrought great changes in the vegetation.

As a first step to destruction of the primitive vegetation roads were made leading into most of the larger valleys. A highway made through the Manawatu Gorge connects the Manawatu River with Hawke's Bay and Wairarapa Plains. Another highway connects Wellington via Rimutaka Saddle to Wairarapa Plains. A little south of this the Wellington–Wairarapa railway crosses the range. The roadmaking has resulted in a most destructive effect on the primitive vegetation. In the author's own experience the native vegetation of the Manawatu Gorge has been reduced enormously within the last ten years. Partly through landslips, consequent upon cutting into hillsides to make room for the road, but largely through repeated cutting and burning of plants along the roadside, introduced plants have been able to obtain a strong root-hold. Among the latter *Foeniculum vulgare, Citysus scoparius, Senecio mikanioides,* and *Vinca major* are especially conspicuous, occupying large stretches.

Timber-milling was once in progress everywhere in the foothills, but now is confined mainly to the vicinity of Otaki Forks and Akatarawa River. *Dacrydium cupressinum* is the much sought-for timber tree. For the most part, especially in the earlier days, the rest of the forest was simply felled and burned and land converted into pastures. Good judgment was not always exercised. Numerous steep hillsides are now to be seen in the Eastern Area either covered with dense growth of *Pteridium aquilinum* or simply running into large screes.

Farms are not always fenced off from the forest reserves. Even so, as a compensation for the maintenance of the fences, farmers are allowed to run their stock a certain distance into the forest, and a few of them, especially on the eastern side, go as far as to run fires through the regenerating forest adjoining their properties. Because of this very fact that the cattle are allowed access to the

forest, the dense growths of shrubs and small trees along the margins are soon destroyed, free movement of air is permitted, humidity is appreciably decreased, and the larger trees die slowly but surely one after another through desiccation. Cases of this kind are fairly common.

There are two fairly large water-supply reserves: one, the upper Orongoronga River basin, controlled by the Wellington City Council, and the other, the Tiritea River basin, controlled by the Palmerston North City Council. There are also three large electric power supply dams: one across the Arapeti River and two across the Mangahao River. Practically all of the remainder of the forested area, as well as higher levels, is Crown land controlled by the State Forest Service.

Through the activity of many tramping clubs in the province practically every part of the mountains is accessible along well cut tracks, and their mountain huts provide shelter at frequent intervals.

Through the activity of early white settlers and especially of the Acclimatisation Societies a number of destructive animals of kinds not known in the country before have been introduced into it, some for purposes of sport, others for real or supposed commercial value. The history of introduction is to be found in G. M. Thomson's *Naturalisation of Animals and Plants in New Zealand.* Cambridge. 1922.

Deer (*Cervus elaphus*) has proved, so far, the most destructive animal on the Tararuas. It is abundant everywhere and especially on and in vicinity of the higher ranges. In many places the ground vegetation is reduced enormously by eating and trampling down. The spongy water-holding property of the soil is also greatly reduced by consolidation. The animal feeds apparently on many herbaceous plants. Of the woody, the following are much favoured: *Schefflera digitata, Nothopanax arboreum, N. Colensoi, N. Sinclairii, N. Edgerleyi, Griselinia littoralis, Coprosma australis, C. foetidissima.* Apart from feeding on the foliage of these species it also browses on their bark. It is quite common to see many of these trees completely ring-barked by deer from about 80 cm. to 160 cm. above ground. In a few places young *Podocarpus ferrugineus* suffers in the same manner. The bark of *Podocarpus Hallii* is often seen stripped, apparently by rubbing with antlers. All these, except perhaps *C. foetidissima,* usually die. At higher altitudes, when snow is on the ground, young *Cordyline indivisa* foliage is much favoured. Many meadow species of the subpolar belt are subject to severe grazing. In this respect the lot of *Aciphylla Colensoi* and *Danthonia antarctica* is conspicuous, especially where they grow more luxuriantly. The pungent, sword-like leaves of the former do not apparently offer it much protection, while the latter is often on many ridges trampled out of existence and the ground is laid barren. There are a number of places of several hectares in extent, such as are to be seen on top of Mount Quoin and the northern shoulder of Mount Omega, where the wet ground was once covered by luxuriant growth of *Danthonia antarctica flavescens* nothing but the numerous decaying crowns of it still remained when last seen in 1933. Its place is now occupied by such low-growing bog species as *Carpha alpina* and *Orcobolus pectinatus.*

Wild cattle (*Bos taurus*) are rather restricted in their distribution on the Tararuas and are practically confined to Otaki Valley, where they are plentiful. Their activity is similar to that of deer.

Goat (*Capra aegargus*) occurs in numbers in Western Area but is most abundant in the Southern Area. Its destructive habits are well known. Of the individual species attacked, *Carmichaelia* and *Edwardsia* seem to suffer most. Many of these plants are to be seen with their crowns hugging the ground, although many years old, because of continuous grazing.

Wild pig (*Sus scrofa*) is plentiful in the forest, but appears to be especially abundant in the warm temperate belt of the Northern Area. Thus, on the slopes of upper Ruamahanga basin, extensive patches of ground are to be seen thoroughly stirred up and practically devoid of ground vegetation, although sprouting seedlings are fairly numerous.

Opossum (*Trichosurus vulpeculus* and *T. fuliginosus*) is plentiful throughout the forest, and is being trapped under licence. Perham (1924) and Cockayne (1928) report very favourably on opossum and consider that it has no important influence on the forest. Recent observations, however, suggest that this animal, like deer, also has selective habits of feeding. Besides, it undoubtedly constitutes potential danger of getting out of control should the market price for its pelts depreciate.

Stoat and weasel (*Putorius* spp.) are reported by the opossum trappers to be numerous. Since they prey on bird life, they necessarily must have indirect effect on the ravages of insects. Nothing of an exact nature is, however, known in this respect.

Rats (*Mus decumanus*) and mice (*M. musculus*) are common, but rabbit (*Lepus cuniculatus*) and hare (*L. europaeus*) are absent. Sheep (*Ovis* sp.) never seem to penetrate into the forest or higher levels.

PLANT FORMATIONS.

V. D. Zotov, N. L. Elder, and A. D. Beddie.

Plant population of the Tararua Mountains presents considerable diversity of character. In the present account only a general description of plant formation is possible. By a plant formation is understood a population dominated by certain species of a particular life form, which had reached its climax development under existing climatic and such edaphic environment which cannot be altered by plants themselves so long as the present geological processes continue undisturbed. Thus, the following important formations are recognised on the Tararuas. In the warm temperate belt: tall forest, which includes *Metrosideros, Dacrydium, Beilschmiedia, Nothofagus, Podocarpus,* and other conspicuous associations; watercourse and riverbank; riverbed. In the cold temperate belt: tall forest (*Nothofagus*); watercourse and riverbank; bog; scrub. In the warm subpolar belt: tussock, herbfield, fell-field, screes, watercourses (including wet rocks), wet ground (including tarns and bogs).

Although these formations are essentially distinct and in general readily recognisable, yet in an area of this size there are bound to occur a number of formations which, though possessing distinctive characters, are of comparatively minor importance and these are somewhat arbitrarily classified together with some related group or else omitted from the present discussion to avoid delving into details. Thus, riverbank and watercourse in the warm temperate belt is extended to include cliff and coastal cliff formations. This has particular advantages in dealing with the southern extremity of the Rimutaka Range, where most of the coastal cliff of the area is situated, as the riverbank and coastal cliff associations are very similar. Tussock, herbfield and scree formations, though only listed for the warm subpolar belt, might have been, but for considerations of space, added as well for the cold temperate belt, in the upper part of which they are occasionally important, but these formations are essentially the same in the two belts.

Another problem which only affects the formations of the lowest zones, is that of dealing with the marginal areas where the indigenous communities have been to a greater or less degree altered or destroyed by the action of man. The boundary taken follows approximately the limit of unbroken forest from the Manawatu Gorge down either flank of the range and on the western side touching the coast at Paekakariki, below Mount Wainui, then cutting across the Hutt Valley to the head of the Wainui-o-mata River and following this to the sea. At the northern and western extremities the forest is, at the present day, discontinuous and some of the existing communities are more or less altered so that a certain amount of inference is necessary as to the original associations, the indigenous formation in which certain species occurred and, to a certain extent, the relative frequency of certain species.

Warm Temperate (0–600 m.) Forest.

Tall forest is the only important formation in this belt. In the lower portion of the belt, more especially in the Northern and Western Areas, the dominant canopy tree is *Metrosideros robusta* or *Dacrydium cupressinum*, the latter's trunk occasionally reaching 2 m. in diameter.

In the climax association *Metrosideros* rules, replacing its foster-tree. Often in the upper portion of the belt *Metrosideros* occupies the same position, but in many places *Nothofagus fusca* dominates. There are local communities where *Beilschmiedia tawa* dominates, particularly in the drier patches of the lower belt, while *Weinmannia racemosa* forms equivalent communities on the ridges of the upper belt. The latter is perhaps the most abundant tree numerically in the Northern and Western Areas. *Melicytus ramiflorus, Nothopanax arboreum, Hedycarya arborea, Knightia excelsa, Cyathea Smithii, Podocarpus ferrugineus* are also important constituents throughout the belt. In the lower belt *Rhopalostylis sapida, Cyathea medullaris, C. dealbata* are abundant, and *Carpodetus serratus* and *Olearia rani* common, while, where the ground approaches swamp, *Laurelia novae-zealandiae* is a physiognomic tree. In the upper part of the belt *Podocarpus Hallii* and *Suttonia salicina* occur in quantity.

Rhipogonum scandens, particularly in the lower three-quarters of the belt, often forms practically impenetrable tangles, and the shade underneath them is so complete that the floor is almost devoid of shrubby or herbaceous plants, and even bryophytes are scanty. *Freycinetia Banksii* also abounds, climbing by roots and heavily festooning trees with its long tufted foliage. Where sufficient light reaches the floor, especially on steep faces, it spreads in a dense entanglement, the heads rising 1–2 m. from the ground. Of other high climbers, *Metrosideros scandens, Clematis indivisa,* and to some extent *Rubus cissoides* also occur. In a lower tier, together with numerous young trees of the higher tiers, *Myrtus pedunculata* in dry stations and *Schefflera digitata* in wet are usually found, while with increase in altitude *Pseudowintera axillaris* and *Senecio Kirkii,* the latter at lower altitudes more usually epiphytic, come in. On the forest floor itself, forming a tier 1 m. in height, the following are abundant, one species now and again becoming dominant:— *Microlaena avenacea, Gleichenia Cunninghamii, Blechnum discolor, Polystichum Richardi, Asplenium lucidum* and *Uncinia riparia. Astelia Cunninghamii, Asplenium bulbiferum* and *Alseuosmia macrophylla* also occur frequently in places.

The ground, decaying logs, trunks and branches of trees and even shrubs are more or less clad with filmy ferns, mosses and liverworts. Large areas of more or less pure *Cardiomanes reniforme* are common, and the following are also plentifully distributed:— *Hymenophyllum dilatatum, H. sanguinolentum, H. biforme, H. demissum,* while *H. tunbridgense, Polypodium Billardieri, Trichomanes venosum* are frequently present. Where more light can penetrate *Lindsaya cuneata* and *Histiopteris incisa* are common.

Perched on the canopy trees the following epiphytes are common: *Astelia Solandri, Dendrobium Cunninghamii, Earina autumnalis, E. mucronata, Asplenium flaccidum* and *Tmesipteris tannensis.*

The following species are common on the outskirts of the forest where the primitive covering has been broken in the course of settlement: *Pteridium aquilinum esculentum,* sometimes dominating limited areas, the climbers, *Muehlenbeckia complexa* and *Metrosideros perforata* and in clearings *Lagenophora pumila* and *L. petiolata.*

The warm temperate forest of the Northern Tararua Area is chiefly noteworthy for the absence, from about Mount Mairakau northward, of *Nothofagus fusca,* which is elsewhere plentiful, and for the presence in abundance of *Mida salicifolia* and *Macropiper excelsum,* while in the vicinity of the Manawatu Gorge *Myoporum laetum* and *Melicope simplex* are common. In the Mangahao valley, *Nothofagus Menziesii,* which further south is mainly confined to the cold temperate belt, descends into the warm belt in appreciable quantity. The Mangatainoka and Ruamahanga valleys also present some peculiarities of vertical distribution, which are dealt with in the ecological section of this paper under local climatic variations.

In the Eastern Tararua Area *Nothofagus fusca* dominates the climax association. *Weinmannia racemosa* is abundant in a lower tier, and the undergrowth, which is very open, is mainly composed of *Cyathea Smithii, Coprosma Banksii, Cyathodes acerosa, Leuco-*

pogon fasciculatus, and *Coprosma rhamnoides* with some *Rhipogonum scandens* and *Freycinetia Banksii.* The floor is thickly covered with dry leaves of *Nothofagus* and *Weinmannia.* The most conspicuous filmy fern is *Cardiomanes reniforme,* which often covers large patches of ground. In some places, particularly where the ground is level, *Blechnum discolor* is plentiful. The bryophyte representation is poor.

In the Southern Tararua Area most of the lowland forest has disappeared. What is left, being fairly close to the sea, shows in several places traces of an admixture of coastal species. In the Muka-muka basin and on the western flank of the area *Corynocarpus laevigata, Myoporum laetum* and *Melicope ternata* are common, while on the west side in addition *Dysoxylum spectabilis* is plentiful. Apart from these areas, the dominant tree of the climax association appears to be *Nothofagus truncata,* co-dominant perhaps in some places with *N. Solandri,* the general aspect of the association resembling that of the Eastern Area, but the following additional species are common: *Danthonia flavescens Cheesemanii, Pittosporum tenuifolium, Macropiper excelsum* and *Melicope simplex. Knightia excelsa* and *Podocarpus spicatus* are also prominent, the latter dominating a local area in the Wairongomai valley.

Warm Temperate Belt: Watercourse, Riverbank, and Cliff.

The watercourse and riverbank formation is essentially younger in succession than the forest which it traverses and differs from it in two ways. Light is freely admitted to much lower levels, so that shrubby and herbaceous species predominate. The perpetual high humidity gives the formation its abundance of bryophytes and pteridophytes. Throughout the whole of the Tararuas there are but slight differences in the associations since they are but little dependent directly on rainfall. The ground generally is densely covered by ferns and mosses and the branches of trees are densely festooned with species of *Weymouthia.* Wet banks are usually occupied by *Gunnera strigosa,* with some *Gnaphalium keriense, Veronica catarractae* (little on the western side), *Pratia angulata* and occasionally *Ourisia macrophylla. Elatostema rugosum* is characteristic of the Northern Area. Frequently *Blechnum procerum* forms pure colonies of considerable area, attaining its maximum development on steep sheltered slopes. Of the taller shrubs *Fuchsia excorticata, Schefflera digitata, Aristotelia serrata,* young *Melicytus ramiflorus, Coprosma australis,* and, in better-lit situations, *Brachyglottis repanda* and *Hebe salicifolia*—the latter with several recognisable varieties occupying separate more or less defined areas—are most common. Of climbing plants *Rhipogonum scandens* and *Freycinetia Banksii* are often present and *Muehlenbeckia australis, Parsonsia heterophylla* and *Rubus cissoides* are not uncommon in the lowlands.

On the more exposed banks, and particularly in rocky gorges, *Carmichaelia odorata* is generally plentiful, and with increasing exposure *Phormium Colensoi* may make its appearance. Of ferns *Adiantum affine* and *Polypodium grammitidis* are common in rocky stations.

At the southern extreme of the area where the Rimutaka Range plunges steeply into the sea at Cape Turakirae the tributaries of the main streams are steeply graded shingle carriers and for several kilometres inland their vegetation is rather that of coastal cliffs than of lowland forest. On the rocky walls of the tributaries of the Muka-muka Stream the dominant species may be *Phormium Colensoi* or *Senecio Greyi,* with *Olearia paniculata, Hebe parviflora, Hebe salicifolia, Veronica diffusa, Linum monogynum, Craspedia uniflora* and *Poa anceps* and other small grasses commonly present. Towards the heads of these streams the association reverts to the general norm, with the exception of the local dominance as a creeping herb of *Jovellana repens,* elsewhere infrequent. In other valleys of the Rimutaka *Leptospermum scoparium* or *Coriaria arborea* and *Cassinia leptophylla* are prominent.

On the coastal cliffs *Muehlenbeckia complexa microphylla* and on the coastal screes *Raoulia australis* are common.

Warm Temperate Belt: Riverbed.

Riverbed formation is more distinctive than riverbank in that it is not in the direct succession to forest. As the shingle settles the first plants to colonise it are *Raoulia tenuicaulis* and *R. t. pusilla,* more commonly the latter. The plants spread quickly, forming a dense and often extensive overground mat, in the shelter of which *Pratia angulata* and *Acaena sanguisorbae* soon appear. Mosses are not of any importance. On the older established ground *Uncinia uncinata* v. ——, *Juncus polyanthemos, Epilobium junceum, Gunnera strigosa* and perhaps also *Microlaena avenacea* become abundantly established. Except on the Western side *Lycopodium scariosum* is common. *Schizeilema trifoliatum, Cotula dioica* and, in the upper part of the belt, *Oxalis lactea* are occasionally plentiful. The climax association appears to be dominated by *Arundo fulvida.* When this is reached or even earlier the forest begins to encroach.

Riverbeds, being generally in close proximity to cultivated areas and not fully occupied by its plant formation, are open to the vigorous invasion of common pasture plants. Among these *Trifolium repens, Holcus lanatus, Anthoxanthum odoratum, Agrostis tenuis* and *Hypochaeris radicata* are the most aggressive, though most other species of the neighbouring district may occur here.

Cold Temperate Belt (600–1200 m.) Forest.

Practically everywhere but in the Northern Tararua Area the *Nothofagus Menziesii* association is the climax within the forest formation, and is practically the only tree to reach the upper limit of forest. With rise of altitude the trees usually become more stunted with close-cropped crowns and short gnarled branches, though on Hell's Gate (1200 m.) the species grows up to 10 m. tall—an exceptional height at this altitude—with trunks up to 1·75 m. in diameter at 1·5 m. above ground level. These are practically free from buttresses unlike those of *N. fusca,* which, when fully developed, frequently are supported by buttresses extensive enough to conceal several men at once.

Within the forest *Nothopanax Colensoi, Coprosma foetidissima,* growing characteristically in a series of curving wands from an

oblique main stem, *C. Colensoi, Suttonia divaricata, Olearia arborescens,* and, on the floor, *Polystichum vestitum* and *Gahnia pauciflora* are usually present in quantity. On tree trunks *Hymenophyllum sanguinolentum* and *H. multifidum* are often profuse, while on the ground, together with bryophytes, they form a dense green carpet almost perpetually saturated with moisture. The tree roots presently lift this from the ground leaving large cavities beneath, which add to the difficulties of progress.

Below 900 m. *N. fusca* is frequently the dominant species in the climax association, and it is in any case common, as are also *Podocarpus Hallii, P. ferrugineous,* and *Weinmannia racemosa.* Of these *Weinmannia* is practically the only species that continues into the upper belt and then in very much reduced numbers. The following smaller trees and shrubs, though plentiful in the lower part of the belt, are likewise seldom found above 900 m.:—*Suttonia salicina, Pseudowintera colorata* (frequently dominant in the Rimutaka Range), *Cyathea Smithii* and in somewhat fewer numbers *Griselinia littoralis* and *Nothopanax Sinclairii.* Beneath these, within 1 m. of the ground, *Blechnum discolor* or *Gleichenia Cunninghamii* may cover large areas of dryer ground, while in moist hollows, deeply shaded, *Leptopteris superba* often grows luxuriantly. *Myrtus pedunculata, Astelia Cunninghamii* and *Microlaena avenacea* are commonly present and on the ground or decaying logs, *Enargea parviflora* and *Libertia pulchella,* the latter being markedly consistent in its upper limit.

In the upper part of the belt and penetrating under favourable conditions even into the lower, the place of the shrubs of lower altitudes is increasingly taken by species more properly considered in the following section under the heading of scrub, such as *Olearia Colensoi, Senecio elaeagnifolius, Coprosma pseudocuneata* and *Pittosporum rigidum,* and *Astelia Cockaynei* which is more typically a plant of the tussock. *Danthonia Cunninghamii* is, however, a forest species and *Olearia lacunosa* mainly so, and these with *Phormium Colensoi* occur commonly.

In the Northern Tararua Area the cold temperate forest is, for the most part, not clearly defined. In the absence of *Nothofagus Menziesii, N. fusca* dominates the climax association on Tawhirikohukohu and in the vicinity of the Mangahao Dam, while *Phyllocladus alpinus* is occasionally dominant about Ngapuketurua. On the other hand *Nothofagus* is practically absent from the eastern side of the area and *Dacrydium biforme* is the dominant species. Otherwise, however, the associations found in this area are but slight modifications of those found elsewhere.

Cold Temperate Belt: Riverbank and Watercourse.

This formation is distinctive in a similar manner to that of the warm temperate belt, but in practically every case the riverbed formation dwindles, within the upper timber line, to insignificance owing to the steepness of the grades and becomes merged with the riverbank and watercourse formation. The latter is generally dominated by *Hebe salicifolia, Aristotelia fruticosa, Hoheria sexstylosa*

var., *Fuchsia excorticata, Pseudowintera colorata* and *Coprosma foetidissima,* while above 900 m. *Olearia Colensoi* and *Senecio elaeagnifolius* often take a large part. *Helichrysum bellidioides, Senecio Solandri* and *Ourisia Macrophylla* are common. *Uncinia* sp., *Microlaena avenacea, Danthonia Cunninghamii* and *Phormium Colensoi* may also occur in quantity. The bryophyte flora is rich.

Cold-Temperate Belt: Scrub.

Scrub formation is extensive in the Northern Tararua Area and on the windward slopes of the Western Tararua Area, but only occurs elsewhere in very restricted extent. Where well-developed it is extremely difficult to penetrate owing to its denseness and the extreme rigidity of the terminal branchlets. Very often the only practicable method of progress is to worm one's way along the ground or even to walk upon the top of the shrubs, except where tracks cut open by tramping clubs or broken open by deer are available and at its worst even deer refuse to face it.

There are a number of distinct associations in the scrub formation, but the one dominated by *Olearia Colensoi* is by far the most common. Other species of significance are *Senecio elaeagnifolius, Coprosma pseudocuneata, C. foetidissima, Nothopanax Colensoi, Pittosporum rigidum* and *Dracophyllum Urvilleanum,* any one of which may become dominant in isolated places. Where scrub occurs in the lower portion of the belt *Weinmannia racemosa* is an important constituent and in the Northern Tararua Area *Phyllocladus alpinus. Olearia arborescens, O. lacunosa, Pimelea longifolia, Hebe buxifolia, Gaultheria rupestris* are very common and among these *Gahnia pauciflora, Danthonia flavescens* and *Phormium Colensoi* occur in many places. Under the scrub *Astelia Cockaynei* is generally plentiful and where light penetrates freely the following are found:—*Euphrasia cuneata* var. *tricolor, Gentiana bellidifolia, G. Grisebachii, Thelymitra uniflora, Danthonia nigricans, Agrostis Dyeri, Lycopodium fastigiatum, Gaultheria depressa, Nertera depressa, N. setulosa, N. dichondraefolia, Cyathodes empetrifolia, Blechnum procerum, Polystichum vestitum, Hymenophyllum sanguinolentum, H. multifidum.*

In several localities in the Northern Area, in particular at its boundary with the Western Area along the ridge between the Mangahao and Otaki rivers leading to Pukematawai, the entire upper part of the belt is under scrub which merges imperceptibly with the Subpolar Belt. Immediately above the timber line, which is here in the vicinity of 900 m., the scrub association is of the usual type, but with increase in altitude this becomes more and more intermingled with tussocks, at first of *Gahnia pauciflora* and later of *Danthonia flavescens,* which grow among the shrubs to a height of 2 m. or more. Higher up the slope shrub species decrease in stature and in numbers to give place to subpolar tussock.

A noteworthy case of scrub formation at a low elevation occurs on the eastern side of the range along the boundary of the Northern and Eastern Areas where it traverses the foothills east of Ruapai. Forest, with *Weinmannia racemosa* dominant and *Podocarpus Hallii,*

P. ferrugineus, Dacrydium biforme, and, unexpectedly, much-stunted *D. cupressinum* fairly common, merges, at about 800 m., gradually on northern and western aspects into tussock meadow with *Phormium Colensoi* strongly in evidence interspersed with scattered scrub species and some windswept *Leptospermum scoparium,* while on southern and particularly eastern faces a conspicuous fringe of stunted *Nothofagus fusca* marks the commencement of a dense scrub formation, dominated by *Olearia Colensoi.* Further along the ridge where, in the vicinity of Tawhero, it exceeds 900 m., the scrub is abruptly replaced by an almost pure association of *Nothofagus Menziesii,* absent elsewhere from the area.

Cold Temperate Belt: Bog.

There are a number of wet places of limited extent in the upper portion of the belt which, although not strictly bogs, may conveniently be classed as such. However, as the particular associations also occur in the Subpolar Belt, it will be convenient to treat of them there, the only additions to the species there listed being *Lyperanthus antarcticus, Prasophyllum Colensoi,* and a small-leaved form of *Ourisia* which are common. True sphagnum bog associations are nowhere extensive in the Tararuas and are confined to the cold temperate belt. The only two which are of any size are in Oriwa Lake-Hollow (Western Area) and on Omega (Southern Area) and these are described in the ecological section of the paper under soil and slope.

Warm Subpolar Belt (1200 m. +).

In the uppermost belt the scrub formation as such is absent, such shrubs as occur are usually scattered through the subpolar tussock, which is the most extensive formation. The following formations are also of some importance: herb-field, fell-field, scree and watercourse. Each, when fully developed, is very distinct, but very often they merge imperceptibly into one another.

Warm Subpolar Belt: Tussock.

The *Danthonia antarctica* var. *flavescens* association is occasionally found almost pure, but only in situations with a comparative degree of shelter from prevailing winds. With greater exposure its place is taken by *D. antarctica* var. ——, a much narrower-leaved jordanon. On a sharp ridge the contrast in colour between the exposed and sheltered side is often most marked, the one pale and tawny, the other a luxuriant dark green. *Astelia Cockaynei* is also abundant and occasionally dominant, while *Dracophyllum rosmarinifolium,* a small heather-like species frequently occupying the crests of ridges, and *Olearia Colensoi,* growing as a semi-prostrate shrub about 50 cm. above ground on sheltered slopes, may be dominant over small areas. *Aciphylla Colensoi* var. *conspicua, Anisotome dissecta, Celmisia spectabilis, Pentachondra pumila, Chrysobactron Hookeri, Ranunculus geraniifolius* and the shrubs *Senecio Bidwillii* and *Hebe Astoni* are generally plentiful. *Dicranoloma* sp. are common ground mosses, but liverworts are practically absent, at any rate in most localities.

Warm Subpolar Belt: Herb-Field.

This is found mainly on the steeper slopes which are at the same time rather damp. The plants do not usually exceed 30 m. in height and are predominantly broad-leaved species. *Astelia Cockaynei* is occasionally dominant, but more frequently one of the following: *Anisotome dissecta, Celmisia spectabilis, C. hieracifolia, Senecio lagopus, Leucogenes leontopodium, Raoulia grandiflora,* or *Pentachondra pumila. Chrysobactron Hookeri, Dracophyllum rosmarinifolium, Senecio Bidwillii* and other herb-field plants are more or less common. Certain species of *Dicranoloma* and *Rhacomitrium* are generally plentiful on the ground.

On more exposed situations, such as rocks, especially on windward slopes, grey-green cushions of *Raoulia rubra,* together with the vivid green ones of *Phyllachne Colensoi* are conspicuous. Among the shorter herbs, *Plantago Brownii, Caltha novae-zealandiae, Drapetes Dieffenbachii, Epilobium pedunculare* and *Carex acicularis* are common, and of grasses *Deyeuxia setifolia* and *Poa Colensoi,* the latter even in abundance.

Warm Subpolar Belt: Watercourse.

As a formation, watercourse is barely distinguishable from herb-field, except in the variety of the species content and in the general luxuriance of vegetation due to the perpetual presence of water and comparative absence of wind, with corresponding increase of humidity. There are numerous associations to be met with, but the following species are characteristic: *Poa Colensoi, Epilobium glabellum, Montia fontana, Ranunculus insignis* and *Senecio lagopus.* In a few places, as, for example, on the south slope of Field Peak facing Mount Hector, *Cotula pyrethrifolia* is important, while in the watercourses to the east of Mount Arête, *Oxalis lactea, Senecio Solanderi, Epilobium glabellum* at 1300 m. are conspicuous.

The following are generally common: *Hierochloe Frazeri, Danthonia antarctica* (both var.), *Deyeuxia setifolia,* several species of *Epilobium, Schizeilema novae-zelandiae, Caltha novae-zealandiae* and numerous mosses and liverworts.

Warm Subpolar Belt: Fell-field.

Fell-field, if, in the Tararua Range, it may be so called, occurs on a few flat-topped, wind-swept knobs and shoulders, or on razor-backs, particularly in the neighbourhood of saddles. Two good examples are to be seen on either side of Mount Hector, the one on Field Peak, the other on the Dress Circle towards Mount Alpha. The associations here are formed mainly of cushion plants, small rosette plants, plants which grow closely appressed to the ground or which otherwise offer little resistance to wind. The following are the dominant species:—Cushions: *Raoulia rubra* (up to 2 m. in diameter, but more generally about 50 cm.), *Phyllachne Colensoi, Raoulia grandiflora.* Rosettes: *Anisotome aromatica, Oreomyrrhis andicola, Plantago Brownii.* Appressed: *Pentachondra pumila, Drapetes Dieffenbachii, Dracophyllum rosmarinifolium, Poa Colensoi, Lycopodium fastigiatum* and *Andreaea* spp.

Warm Subpolar Belt: Screes.

Although the formation is extremely open and with a poor representation of species, nevertheless the following are frequently plentiful. *Claytonia australasica, Juncus antarcticus, Oreomyrrhis andicola* and *Cardamine heterophylla. Ourisia caespitosa* and *Geum parviflorum* are occasionally present, and not infrequently *Ranunculus insignis,* with a few other plants from the neighbouring watercourses, obtains a footing on screes.

ANALYSIS OF THE PLANT FORMATIONS.

Belts	Formations	Frequencies	Canopy trees (usu. over 10 m. tall)	Small trees (usu. 4-10 m. tall)	Tuft trees	Rigid shrubs	Twiggy shrubs	Lianes	Hemiparasites	Perching epiphytes	Drooping epiphytes	Mat epiphytes	Tufted linear-leaved herbs ± 1 m. tall	Tufted linear-leaved herbs < 1 m. tall	Ferns (ground)	Herbs with tubers	Herbs with rhizomes	Herbs with stolons	Rosettes	Other herbs	Cushions
WARM SUBPOLAR BELT	Screes	*r-rr*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	2	—
		f-cc	—	—	—	—	—	—	—	—	—	—	—	3	—	—	1	1	—	1	—
		p-dd	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Fell-field.	*r-rr*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
		f-cc	—	—	—	—	—	—	—	—	—	—	—	2	1	—	—	—	1	2	—
		p-dd	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	3	2
	Water-course	*r-rr*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
		f-cc	—	—	—	1	—	—	—	—	—	—	—	1	—	—	—	—	1	1	—
		p-dd	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—	1	—	1	—
	Herb-field	*r-*	—	—	—	—	1	—	1	—	—	—	—	5	—	1	1	1	—	1	—
		f-	—	—	—	—	1	—	—	—	—	—	—	4	—	—	—	1	3	6	—
		p-	—	—	—	—	—	—	—	—	—	—	—	14	—	—	—	1	1	2	—
	Tus-sock.	*r-*	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—
		f-	—	—	—	1	1	—	—	—	—	—	—	2	—	—	—	—	—	1	—
		p-	—	—	—	—	—	—	—	—	—	—	1	3	—	—	—	—	—	2	—
	Total	.. ..	—	—	—	2	3	—	1	—	—	—	1	34	3	1	2	7	8	19	3
COLD TEMPERATE BELT	Bog	*r-*	—	—	—	—	—	—	—	—	—	—	—	3	—	1	—	—	—	—	—
		f-	—	—	—	—	1	—	—	—	—	—	1	1	—	4	—	2	3	6	—
		p-	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
	Scrub	*r-*	—	—	—	3	1	—	—	—	—	—	—	—	—	—	—	—	1	2	—
		f-	—	—	—	10	6	—	1	—	—	—	2	5	1	—	—	—	—	2	—
		p-	—	—	—	5	—	—	—	—	—	—	1	—	—	—	—	—	—	1	—
	Water-course	*r-*	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	4	—	4	—
		f-	—	2	—	—	1	—	—	—	—	—	—	9	1	—	—	5	—	6	—
		p-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
	Forest	*r-*	1	3	—	—	—	—	—	—	—	1	—	1	3	1	—	—	—	1	—
		f-	5	5	2	1	6	1	—	—	3	—	1	4	6	—	—	1	—	—	—
		p-	5	2	1	1	2	—	—	—	—	3	2	4	2	—	—	—	—	—	—
	Total	.. ..	6	12	3	18	17	1	1	—	3	4	7	26	14	6	—	10	4	23	—
WARM TEMPERATE BELT	River Bed.	*r-*	—	—	—	—	—	—	—	—	—	—	4	10	1	13	—	7	3	19	—
		f-	—	—	—	—	1	—	—	—	—	—	2	2	3	2	—	1	—	5	—
		p-	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	1	—
	Water crs. & River bank.	*r-*	—	—	—	—	8	2	—	—	—	—	2	13	2	3	—	—	—	11	—
		f-	—	2	2	2	6	1	—	—	—	—	2	9	2	1	—	2	—	9	—
		p-	—	1	—	—	2	—	—	—	—	—	—	2	—	—	—	2	—	—	—
	Forest.	*r-*	7	12	1	8	11	10	4	3	2	3	1	3	15	1	—	8	—	12	—
		f-	10	12	3	1	14	8	2	5	8	6	2	4	16	2	—	1	2	6	—
		p-	6	6	1	—	—	2	—	—	—	3	1	1	3	—	—	—	—	—	—
	Total	.. ..	23	32	7	11	42	23	6	8	10	12	14	46	43	22	—	22	5	49	—
	Grand total..		25	39	8	30	57	23	8	8	10	13	16	75	52	29	2	39	15	6 8	3

Warm Subpolar Belt: Bog.

The chief characteristic of the area here considered is the close turf, forming a stiff crust to the soft peaty soil beneath and the sparse occurrence, depauperation or complete absence of the taller species of adjacent formations. A distinct xerophytic habit characterises all the dominant species, undoubtedly due to the fact that during the summer most of them dry up at intervals and perhaps also to their continual exposure to drying winds.

The dominant constituents of the association are usually some of the following: *Schoenus pauciflorus, Carpha alpina, Oreobolus pectinatus, Gaymardia ciliata, Astelia linearis.* Generally common are *Caltha novae-zealandiae, Plantago Brownii, P. uniflora* (especially on the brinks of tarns), *Isolepis aucklandicus, Juncus antarcticus, Drosera stenopetala, Forstera Bidwillii, Caladenia bifolia, Coprosma repens,* and in several localities *Abrotanella pusilla.* Stunted forms of *Ranunculus geraniifolius* (particularly the variety with much dissected leaves), *Celmisia spectabilis, C. hieracifolia oblonga,* and *Senecio lagopus* are also commonly present.

DISTRIBUTION OF SPERMATOPHYTA AND PTERIDOPHYTA.

By V. D. Zotov, N. L. Elder, A. D. Beddie.

Previously published lists of species collected from the Tararua Mountains are either too fragmentary or cover but isolated narrow routes only. Besides, the very scanty information supplied with them is often erroneous or tends to give an erroneous impression. It would appear from the information given in Cheeseman's *Manual* that about 236 species more than so far recorded from the Tararuas should occur there by reason of the fact that they occur on the mountains both north and south of the Tararuas. Because of the above reasons and the large amount of fresh information accumulated it is very desirable to publish a thoroughly revised and enlarged list of species together with notes on their distribution.

In the following list the past records are checked fairly, if not quite, completely, and persons making records are noted. Only the specific citations for the Tararua Mountains are here accepted as *recorded* for them.

In its arrangement of species the list closely follows that of the *Manual,* but a number of departures are made in nomenclature so as to bring this up to date as nearly as possible. No attempt is being made here to describe any new species and varieties or correct any known errors which crept into the *Manual* and which have not yet been formally published, except where this is absolutely necessary to avoid possible confusion. It is hoped that in all cases of alteration of specific names there is sufficient means of identifying them with those of the *Manual.* It must be stressed here that no attempt is being made to distinguish Tararuan jordanons from those elsewhere, although there is usually more than one very distinct jordanon in every species. Only in those species which are represented on the Tararuas by more than one recognised jordanon are the varieties indicated.

FIG. 1.—Timber-line at its maximum altitude. Eastern slope of Mt. Alpha, c. 1200 m. FIG. 2.—Forest advancing on to the scrub is being cut off from the main body of the forest by the scrub. South-western slope of West Peak (near Mt. Hector) c. 1050 m. FIG. 3.—Note effect of the moist north-westerly wind on distribution of formations. A small hanging valley just below the main divide (left) which is c. 1200 m., looking south. FIG. 4.—A naturally drained bog—now dry—but supporting only a scanty vegetation. Oriwa Lake-Hollow.

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Fig. 5.—Wind-channelled tussock on the north-westerly slope of the high ridge north-east of Mt. Holdsworth. Fig. 6.—*Raoulia rubra-Phyllachne Colensoi* association on top of wind-swept West Peak (near Mt. Hector) c. 1360 m. Fig. 7.—Prostrate growth of *Nothofagus Menziesii* and *Dracophyllum Urvilleanum* on the wind-swept north-western slope of a knob (c. 1100 m.) near Mt. Omega. Old trees are here only about 50 cm. high. Fig. 8.—*Dracophyllum-Sphagnum* bog on Mt. Omega.

Fig. 9.—Interior of *Olearia colensoi* scrub on western slope of Mt. Waiopehu, c. 100 m. The scrub here is 2-3 m. high. Fig. 10.—Interior of forest in Ohau Valley (Western Area), c. 200 m. J. Nicholls, photo.

Fig. 11.—*Freycinetia banksii* climbing up the trunk of *Laurelia nova-zealandiae*. Ohau Valley, c. 200 m. Fig. 12.—*Rhipogonum scandens* entanglements, Tiritea Valley (western side of Northern Area), c. 150 m. The ground is covered with dead leaves. Fig. 13.—Herb-field on Mt. Pukematawai (near Mt. Arete), c. 1450 m. The larger plants seen are *Celmisia spectabilis*, *Leucogenes leontopodium*, and *Danthonia antarctica* var.

Fig. 13a.—*Usnea* sp. festooning *Nothofagus menziesii*. Mt. Holdsworth (Eastern Area), c. 1200 m. Fig. 14.—*Nothofagus fusca-Weinmannia racemosa* forest on eastern slope of Mt. Holdsworth (Eastern Area), c. 600 m. Fig. 15.—Bryophyte-clad young *Podocarpus hallii*. Near Field Hut (Western Area), c. 850 m. Fig. 16.—*Weinmannia racemosa-Nothofagus menziesii* forest on a western slope near Tematawai Hut (near Mt. Waicpehu), c. 200 m.

Fig. 17.—*Raoulia rubra-Phyllachne colensoi* association on wind-swept slope of Mt. Hector, c. 1500 m. Fig. 18.—*Cordyline indivisa* near Mt. Omega, c. 1000 m. The young leaves of the trees 1-2 m. high were attacked by deer during winter of 1932. All trees in the grove of some 30 are now dead. Fig. 19.—*Aciphylla colensoi conspicua* in *Danthonia* tussock on Mt. Hector, etc., 1150 m. Fig. 20.—*Dacrydium cupressinum-Metrosideros robusta-Weinmannia racemosa* forest on a western slope, Western Area, c. 600 m. *Gleichenia cunninghamii* in foreground; in centre *Senecio kirkii* in flower.

Fig. 21.—Aerial roots of *Griselinia lucida* encircling the trunk of *Corynocarpus laevigata*. Mukumuku Valley, Southern Area. Fig. 22.—*Griselinia littoralis* ringbarked by deer from 1 to 2 m. from the ground. Fig. 23.—Uppermost branches of *Nothofagus menziesii* from timber-line near Field Hut (western slope), Western Area, c. 900 m. Fig 24.—Uppermost branches of *N. menziesii* from timber-line on eastern slope of Mt. Alpha, Eastern Area, c. 1200 m. The scale of the photographs 23 and 24 is identical (about x $\frac{1}{4}$). Figs. 25.—*Podocarpus hallii* showing shade (left) and sun foliage (right). In scrub formation frequently only the sun foliage is prominently developed.

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Insert under abbreviations p. 291:—

NTA: North Tararua Area.
STA: South Tararua Area.
ETA: East Tararua Area.
WTA: West Tararua Area.
ATA: All Tararua Area.

ABBREVIATIONS.

A: Aston, 1910.
B: Beddie, —.
Bu: Buchanan, 1874.
C: Cockayne, 1906.
E: Elder, —.
K: Kirk, 1899.
M: Cheeseman, 1925.*
O: Oliver (or Heine in O), 1935.
P: Petrie, 1908.
To: Townson, in M.
Tr: Travers, in M.
W: Aston, 1911.
X: Not observed by B, E, or Z.
Z: Zotov, —.
oo: More than two collectors in M.
* (Example: M—A! = collected by A, seen by Cheeseman and recorded for Tararuas in M).

LWSubp: lower warm subpolar belt.
UCTemp: upper cold temperate belt.
LCTemp: lower cold temperate belt.
CTemp: both U+L cold temperate b.
UWTemp: upper warm temperate b.
LWTemp: lower warm temperate b.
WTemp: both U + L warm temperate belt.
Temp: both cold and warm temperate belt.

bog: ± permanently wet open ground.
ep: true epiphyte.
fell: fellfield.
forest: tall forest.
herb: herb field.
mead: meadow, tall tussock, etc.
river: riverbed.
rocks: rocks, e.g. in gorges or on peaks.
scrub: cold temperate scrub.
water: watercourse and river bank.

dd: single dominant.
d: co-dominant.
pp: very plentiful.
p: plentiful.
cc: very common.
c: common.
ff: very frequent.
f: frequent.
rr: rather rare.
r: rare or very rare.

PTERIDOPHYTA.

Hymenophyllaceae.

Hymenophyllum rarum Swartz.—A,Z. WTemp, ATA, ep, f.
H. sanguinolentum Swartz.—A,B,Z. Temp, ATA (CTemp, pp).
H. villosum Col.—Z. LCSubp, ATA, rock, f.
H. australe Willd.—Z. LWTemp, NTA, r.
H. pulcherrimum Col.—Z. LCTemp, WTA, r.
H. dilatatum Swartz.—A,B,Z. WTemp, ATA, p.
H. demissum Swartz.—A,B,Z. WTemp, LCTemp, ATA, p.
H. scabrum A. Rich.—A,B,Z. WTemp, ATA, ff.
H. flabellatum Lab.—A,X.
H. ferrugineum Colla.—A,B,Z. WTemp, ATA, rr.
H. tunbridgense Smith.—A,B,Z. WTemp, ATA, c.
H. peltatum Desv.—Z. c. 500 m., WTA (nr. Field Hut, only specimen).
H. multifidum Swartz.—A,B,Z. WTemp, ff, CTemp, pp-dd, ATA.
H. bivalve Swartz.—A,B,Z. WTemp, ATA, c.
Cardiomanes reniforme Presl.—A,B,Z. WTemp, ATA, pp.
Trichomanes Colensoi Presl.—M—Bu!,X.
T. venosum Presl.—A,Z. WTemp, ATA, ep, ff.
T. strictum Presl.—A,X.

Cyatheaceae.

Dicksonia squarrosa Swartz.—A,B,Z. LWTemp, NTA, STA, ff.
Cyathea dealbata Swartz.—A,B,Z. LWTemp, ATA, c.
C. medullaris Swartz.—A,B,Z. LWTemp, ATA, c.
C. Smithii Hook. f.—A,B,Z. WTemp, LCTemp, ATA, pp.
C. Colensoi Domin.—A,Z. LWTemp, NTA, ETA, r.

Polypodiaceae.

Cystopteris fragilis Bernh.—M—Bu,X.
Polystichum vestitum Presl.—A,B,Z. CTemp, ATA, pp.
P. Richardi J. Smith.—A,B,Z. WTemp, ATA, cc.
P. cystostegia J. B. Armstr.—M—Bu,X.
P. hispidum J. Smith.—B,Z. WTemp, NTA, STA, rr.
P. adiantiforme J. Smith.—B,Z. WTemp, ATA, rr.
Dryopteris glabella C. Christensen.—A,B,Z. WTemp, ATA, f.
D. punctata C. Christensen.—A,Z. WTemp, WTA, rr.
D. pennigera C. Christensen.—A,B,Z. LWTemp, ATA, f.
Leptolepia novae-zealandiae Kuhn.—A,B,Z. LWTemp, ATA, rr.
Arthropteris tenella J. Smith.—B,Z. c. 100 m., nr. Manawatu Gorge, also nr. Porirua Harbour.
Lindsaya cuneata Swartz.—A,B,Z. WTemp, ATA, cc.
Asplenium flabellifolium Cav.—B. WTemp, Mt. Matthews (STA), r.
A. trichomanes Linn.—M—Bu, X.
A. adiantoides C. Christensen.—A,B,Z. LWTemp, ATA, ep, rr.
A. obtusatum Forst. f.—A,X.
A. lucidum Forst. f.—A,B,Z. LWTemp, ATA, c.
A. Hookerianum Col.—A,B,Z. WTemp, STA, f.
A. Colensoi Moore.—B. WTemp, STA, rr.
A. bulbiferum Forst. f.—B,Z. WTemp, ATA, c.
A. Richardi Hook. f.—M—Bu, —H. C. Field, X.
A. flaccidum Forst. f.—A,B,Z. WTemp, LCTemp, ATA, ep, c.
A. bulbiferum × *Hookerianum*.—B,Z.
A. bulbiferum × *flaccidum*.—B.
A. Hookerianum × *flaccidum*.—B.
Blechnum Patersoni Mett.—A,B,Z. WTemp, ATA, c.
B. discolor Keys.—A,B,Z. WTemp, LCTemp, ATA, d-dd.
B. vulcanicum Kuhn.—A,X.
B. lanceolatum Sturm.—A,B,Z. WTemp, ATA, gorges, ff.
B. Banksii Mett.—B. Cliffs, nr. coast, r.
B. penna-marina Kuhn.—A,B,Z. c. 900 m., Park Valley, c; also Big Hill (STA), rr.
P. procerum Labill.—A,B,Z. WTemp, CTemp, ATA, cc. There appear to be at least two jordanons.
B. minor Hook. f.—B,Z. LCTemp, ATA, cc. (UWTemp in Ruamahanga upper basin).
B. filiforme Ettingsh.—A,B,Z. WTemp, ATA, ep. c.
B. nigrum Metten.—Z. WTemp. WTA, on steep slopes, c.
B. fluviatile Salom.—A,B,Z. WTemp, ATA, ff.
Pellaea rotundifolia Hook.—B,Z. c. 100 m., vicinity of Manawatu Gorge, nr. Mt. Matthews, r.
H. tenuifolia Bernh.—B. LWTemp, STA, rr.
Hypolepis millefolium Hook.—A,M—A!—To,B. CTemp, STA, rare; Z. Park Valley, c. 1200 m., c.
H. distans Hook.—A,X.
Adiantum formosum R. Br.—Z. c. 100 m., Manawatu Gorge.
A. affine Willd.—A,B,Z. LWTemp, ATA, gorges, c.
Pteris tremula R. Br.—B,Z. WTemp, NTA, ETA, STA, ff.
P. macilenta A. Rich.—B, LWTemp, Mt. Matthews (STA), f.

Histiopteris incisa J. Smith.—A,B,Z. WTemp, ATA, c.
Pteridium aquilinum esculentum Hook. f.—A,B,Z. WTemp, ATA, c-dd.
Paesia scaberula Kuhn.—A,B,Z. WTemp, ATA, r (except on clearings).
Polypodium Billardieri C. Christensen.—A,B,Z. Temp, ATA, c.
P. b. var.—Z. CTemp, ATA, ff. Smaller and more slender than the former.
P. b. var.—Z. LWSubp, wet rocks, r. Much broader than the original species.
P. grammitidis R. Br.—A,B,Z. WTemp, ATA, c, on rocks.
P. pustulatum Forst. f.—B,Z. LWTemp, ATA, rr.
P. diversifolium Willd.—B,Z. WTemp, ATA, rocks or ep, ff.
Cyclophorus serpens C. Christensen.—A,B,Z. WTemp, LCTemp, ATA, rocks or ep, ff.

Gleicheniaceae.

Gleichenia dicarpa R. Br.—B,E. WTemp (?), STA, r.
G. alpina Hook. f.—B,E. c. 800 m., Mt. Kapakapanui and Mt. Orongorongo, r; E. c. 800 m., Mt. Kaiparoro, r.
G. Cunninghamii Heward.—A,B,E,Z. LCTemp, ATA, c-pp; UWTemp, f.

Schizaeaceae.

Schizaea fistulosa Labill.—E. c. 200 m., nr. Port Nicholson in manuka.

Osmundaceae.

Leptopteris hymenophylloides Presl.—A,B,Z. UWTemp, LCTemp, ATA, ff.
L. superba Presl.—A,B,Z. LCTemp, ATA, cc.

Ophioglossaceae.

Ophioglossum coriaceum A. Cunn.—E,B,Z. c. 300 m., Tauherenikau and lower Waiohine River flats, cc.
Botrychium australe millefolium (?) Plantl.—B,E. c. 300 m., Waiohine River flats (ETA), Muku-muku basin (STA), r.

Lycopodiaceae.

Lycopodium australianum Nerter.—B,E,Z. LWSubp, ATA, rr; also Mt. Matthews, c. 900 m.
L. varium R. Br.—B,E,Z. UWTemp, LCTemp, ATA, f.
L. Billardieri Spring.—B,E,Z. WTemp, ATA, f.
L. fastigiatum R. Br.—B,E,Z. Temp, ATA, r; LWSubp, c.
L. scariosum Forst. f.—B,E,Z. Temp, NTA, ETA, STA, c; WTA, rr.
L. volubile Forst. f.—A,B,Z. WTemp, ATA, r.
Tmesipteris tannensis Bernh.—A,B,E,Z. WTemp, ATA, ep, c.

SPERMATOPHYTA—GYMNOSPERMAE.

Pinaceae.

Libocedrus doniana Endl.—Bu,X.

Taxaceae.

Podocarpus totara D. Don.—B,E,P,Z. LWTemp, ATA, river, ff.
P. Hallii T. Kirk.—A,B,E,Z. UWTemp, LCTemp, ATA, cc.
P. nivalis Hook.—Bu,W—Bu,X. = epharmone *P. Hallii*?

P. ferrugineus D. Don.—B,E,P,Z. WTemp, LCTemp, pp-d.
P. spicatus R. Br.—A,B,E,Z. LWTemp, ATA, r; STA, c-dd.
P. dacrydioides A. Rich.—B,P,Z. LWTemp, ATA, river, r.
Dacrydium biforme Pilger.—E,Z. CTemp, NTA, c-d.
D. intermedium T. Kirk.—W,M—oo!, X = *D. biforme*?
D. cupressinum Soland.—B,E,P,Z. WTemp, ATA, c; NTA, WTA, dd.
Phyllocladus trichomanoides D. Don.—Bu,W—Bu,X. = *P. alpinus*?
P. alpinus Hook. f.—E,Z. CTemp, NTA, pp–dd; nr. Mt. Renata (STA), isolated patch.

SPERMATOPHYTA—MONOCOTYLEDONAE.

Pandanaceae.
Freycinetia Banksii A. Cunn.—B,E,P,Z. WTemp, ATA, c-pp.

Niadaceae.
Potamogeton Cheesemanii A. Bennett.—c. 300-400 m., ETA, STA, r.

Gramineae.
Oplismenus undulatifolius Beauv.—P,X.
Microlaena Colensoi Petrie.—P,W,M—Tr!,Z. LWSubp, pp.
M. stipoides R. Br.—Z. LWTemp, Manawatu G., Muku-muku R., Paekakariki cliffs, c, probably introduced into the loc.
M. avenacea Hook. f.—B,P,Z. WTemp, LCTemp, ATA, pp-d.
Hierochloe redolens R. Br.—P,Z. UCTemp, ATA, ff.
H. Fraseri Hook. f. var.—P,Z. UCTemp, ATA, f.
Echinopogon ovatus Beauv.—c. 100 m., Manawatu Gorge, r; Big Hill (STA), r.
Agrostis alpina Scop.—Z. LWSubp, ATA, rr; CTemp, Waiohine-iti V., c.
A. subulata Hook. f.—A,P,M—P!, X = preceding sp.?
A. muscosa T. Kirk.—P,W,M—oo!, Z. LWSubp, rr.
A. Dyeri Petrie.—P,W,Z. LWSubp, p.
A. parviflora R. Br.—Z. CTemp, ATA, in open places, ff; Mt. Waiopehu, pp.
Deyeuxia Forsteri Kunth.—B,P,Z. Temp, ATA, f. There appear to be several jordanons.
D. avenoides Buch.—B,Z. WTemp, Mt. Matthews, r.
D. setifolia Hook. f.—B,P,Z. CTemp (rr), LWSubp, c.
D. quadriseta Benth.—A,Z. WTemp, NTA, ETA, STA, r.
Dichelachne crinita Hook. f.—A,B,Z. WTemp, NTA, ETA, STA, r.
Deschampsia tenella Petrie.—P,W—Tr, M—Tr!—P!, Z. LWSubp, r; C Temp, Ruamahanga upp. basin, Waiohine-iti V., cc.
Trisetum antarcticum Trin.—B, P—A?, Z. CTemp, ETA, r; STA, ff.
T. Youngii Hook. f.—P—A?, W,M—Bu!—A!, Z. WTemp, NTA, r (probably introduced).
T.y. saxeticolum (Ckn. et Allan).—Z. Coastal cliffs, STA, ff.
Danthonia Cunninghamii Hook f.—A,B,Z. CTemp, forest, pp.
D. Bromoides Hook. f.—B,Z. Mouth of Muku-muku R., c.

D. antarctica Hook. f. *flavescens* (Hack.)—B,Z. CTemp (except in forest), c; LWSubp, dd.
D.a. Cheesmanii (Hack.) (?).—B,Z. WTemp, forest, STA, c.
D.a. var. (narrow-leaved).—B,Z. LWSubp, pp–dd; UCTemp, Park V., p.
D. Raoulii Steud.—P,X. Probably includes *D. antarctica* and *D. Cunninghamii.*
D. semiannularis R. Br.—B,P,Z. WTemp, rr, probably introduced.
D. nigricans Petrie.—B,Z. CTemp, open places, pp.
D. pilosa R. Br. var.—B,Z. WTemp, STA, ff. possibly introduced.
D. setacea R. Br. *setifolia* (Hook. f.).—Z. NTA, WTemp, in gorges, CTemp, E. slopes of Mt. Ruapai cc–dd; Park V., p.
D. nuda Hook. f.—M—A!, X.
Arundo conspicua Forst. f.—A,B,Z. LWTemp, NTA, STA, introduced?
A. fulvida Buch.—B,Z. WTemp, ATA, ff.
Triodia australis Petrie.—P,W,X. Petrie's record of this S.I. species is doubtful, although there is a specimen in the Dominion Museum labelled "Mt. Holdsworth."
Poa novae-zelandiae Hack.—B,P,W,M—Bu!—Johns!, Z. LWSubp, c.
P. anceps Forst. f.—B,P,Z. Temp, ATA, c. There appear to be two distinct jordanons, one found in WTemp, the other in CTemp.
P. seticulmis Petrie.—A,W,X. = epharmone of *P. anceps?*
P. caespitosa Forst. f.—B,P,Z. LWTemp, ETA, STA, f, on steep slopes, introduced?
P. Colensoi Hook. f.—B,P,Z. LCSubp, pp.
P. Kirkii Buch.—B,W,M—Tr—Arnold,Z. LWSubp, c.
P. imbecilla Forst. f.—B,P,W,Z. LWSubp, c.
P. n.sp. (usu. placed in *P. imbecilla*).—Z. WTemp, STA, rr.
Festuca multinodis Petrie.—B,Z. Coastal cliffs (STA), cc.
F.m. var.—Z. Low rocks in Manawatu Gorge, pp.
Agropyron scabrum Beauv. (glaucous var.).—B,Z. Coastal cliffs and Manawatu Gorge, rr.

Cyperace.

Mariscus ustulatus C. B. Clarke.—B,Z. LWTemp, NTA, STA, f, introduced?
Eleocharis Cunninghamii Boeck.—A,X. = E. acuta?
E. acuta R. Br.—B,Z. WTemp, ATA, cut-off meanders, c.
Isolepis n.sp. (related to *I. basileris* Hook. f.).—B,Z. LWTemp, Muku-muku basin, r. Possibly exotic to N.Z.
I. aucklandica Hook. f.—B,M—A!—P!,P,Z. CTemp, LWSubp, cc.
I. cernua Roem. et Schult.—A,B,Z. WTemp, ATA, ff.
I. inundata gracillima (Cheesem.).—c. 600 m. High misty (STA), introduced.
I. sulcata distigmatosa (C. B. Clarke).—A,B,Z. LWTemp, ATA, water, ff.
I. prolifer R. Br.—A,B,Z. LWTemp, ATA, water, ff.

I. sulcataus × *prolifer.*
I. nodosa R. Br.—B,Z. Coastal, invades bared land.
Scirpus novae-zealandiae Col.—B. Muku-muku R. Introduced.
S. lacustris Linn.—B. Muku-muku R. Introduced?
Carpha alpina R. Br.—B,P,Z. CTemp, ATA, c, in open places, LWSubp, pp.
Schoenus pauciflorus Hook. f.—B,P,Z. LWSubp, pp.
Cladium Sinclairii Hook, f.—Manawatu Gorge, rocks, rr.
C. glomeratum, R. Br.—B. L.Ponui (STA).
C. Gunnii Hook. f.—B. L.Ponui (STA).
Lepidosperma australe Hook. f.—B,Z. WTemp, NTA, STA, r. Introduced.
Gahnia setifolia Hook. f.—B,P,Z. LWTemp, ATA, r.
G. pauciflora T. Kirk.—B,P,Z. WTemp, ATA, ff.
G.p. var. (possibly distinct sp.).—B,P,Z. CTemp, ATA, cc.
G. gahniaeformis A. A. Heller.—B. WTemp, STA, r.
Oreobolus strictus Berggr.—W,X.
O. pumilio R. Br.—Z. c. 660 m., Mt. Maunganui, ff.
O. pectinatus Hook. f.—B,P,Z. CTemp, LWSubp, pp.
Uncinia compacta R. Br.—P,W—Bu,M,Z. LWSubp, f. Possibly epharmone of *U. fusco-vaginata.*
U. fuco-vaginata Kukenth.—P,M—oo!Z. UCTemp, LWSubp, ATA, c.
U. purpurata Petrie.—W—P, X.
U. caespitosa Boott.—P,M—P!,Z?
U. uncinata Kukenth.—B,P,Z. UWTemp, LCTemp, ATA, c; STA pp.
U.u. ferruginea C. B. Clarke.—Z. LWTemp, ATA, f; NTA, pp.
U. leptostachya Raoul.—B. WTemp, STA, r.
U. riparia R. Br.—B,Z. CTemp, ATA, cc.
U.r. Banksii C. B. Clarke.—Z. WTemp, ATA, ff.
U. strictissima Petrie.—B,Z. LWTemp, Muku-muku basin (STA), f.
U. rupestris Raoul.—P,W—Tr,Z. CTemp, ATA, cc.
U. filiformis Boott.—B,P,W,M—oo!, Z. LCTemp, ATA, cc.
Carex acicularis Boott.—P,W,M—P!,Z. LWSubp, ff.
C. appressa R. Br.—B. WTemp, Mt. Matthews (STA), r.
C. secta Boott.—B,Z. LWTemp, ATA, river flats, rr.
C. Colensoi Boott.—Z. CTemp, Mt. Holdsworth (ETA), r.
C. subdola Boott.—B. c. 600 m., Mt. Orongorongo (STA), r.
C. ternaria Forst. f.—B,P,Z. LWTemp, ATA, rr.
C.t. gracilis Cheesem.—Z. Manawatu Gorge, r.
C. lucida Boott.—B,Z. WTemp, NTA, ETA, STA, r.
C. comans Berggr.—B,Z. WTemp, ETA, STA, rr.
C. dissista Sol.—B,P,Z. CTemp, ATA, ff.
C. monticola Kukenth.—B,Z. WTemp, LCTemp, ATA, c.
C. Solanderi Boott.—B,Z. LWTemp, Orongorongo and Muku-muku basin, rr.
C. semi-forsteri C. B. Clarke.—B. LWTemp, nr. Mt. Matthews, r.

Palmae.

Rhopalostylis sapida Wendl.—B,E,Z. LWTemp, ATA, ff.

Centrolepidaceae.

Gaimardia ciliata Hook. f.—E,P,M—P,Z. LWSubp, cc.

Juncaceae.

Juncus pallidus R. Br.—B,Z. LWTemp, ATA, river, r.
J. pauciflorus R. Br.—B,Z. LWTemp, ATA, river, r.
J. vaginatus R. Br.—B,Z. LWTemp, ATA, river, r.
J. polyanthemos Buchen.—B,Z. Temp, ATA, wet open places, ff.
J. luxurians Col.—B,Z. LWTemp, ATA, river, r.
J. pallidus × *vaginatus.*
J. pallidus × *polyanthemos.*
J. vaginatus × *polyanthemos.*
J. planifolius R. Br.—A,B,Z. WTemp, ATA, f. Two varieties, one chiefly in NTA, WTA, the other in ETA, STA.
J. caespiticus bracteatus Buchen.—A,B,Z. LWTemp, Mt. Matthews (STA), f.
J. antarcticus Hook. f.—B,E,P,W,Z. UCTemp, LWSubp, ATA, cc.
J. prismatocarpus R. Br.—Z. LWTemp, NTA, Tiritea and Kahuterawa riverbeds, r.
J. scheuchzeroides Gaud.—A,X.
J. novae-zealandiae Hook. f.—B,P,W,Z. CTemp, ATA, ff.
Luzula Colensoi Hook. f.—W—To,M—To !,X.
L. campestris DC.—A,B,M,P,Z.
L.c. picta Hook. f.—B,Z. WTemp, LCTemp, ATA, c.
L.c. australasica Buchen.—B,Z. CTemp, ATA, c.
L.c. floribunda Buchen.—B,Z. CTemp, ATA, water, f; LWSubp, cc.

Liliaceae.

Rhipogonum scandens Forst.—B,E,P,Z. WTemp, ATA; STA and other drier places, r–f, elsewhere up to 450 m. pp–dd.
Enargea parviflora Scottsberg.—B,E,P,Z. LCTemp, ATA, cc.
Cordyline Banksii Hook. f.—B,E,P,Z. WTemp, LCTemp, ATA, water, f.
C. australis Hook, f.—B,Z. LWTemp, nr. Manawatu Gorge, Muku-muku basin, f.
C. indivisa Steud.—B,E,P,Z. CTemp, ATA, ff.
Astelia linearis Hook. f.—B,E,P,Z. UCTemp, ATA, rr; LWSubp, p.
A. Solanderi A. Cunn. (= *Cunninghamii* Hook. f. of Manual).—B,E,P,Z. WTemp, LCTemp, ATA, pp.
A. Haastata Col.—B,E,P,Z. WTemp, ATA, ep, cc.
A. Cunninghamii × *Solanderi.*—Z.
A. nervosa Banks et Sol.—B,E,P,Z. CTemp, ATA, pp.
A. Cockaynei Cheesem.—B,E,Z. UCTemp, LWSubp, pp–dd.
Dianella intermedia Endl.—B,E,P,Z. WTemp, ATA, f.
Phormium tenax Forst.—A,X.
P. Colensoi Hook. f.—B,E,P,Z. CTemp, ATA, pp–dd; WTemp, in gorges and coastal cliffs, c.
P. Colensoi × *tenax.*—B,Z. on coastal cliffs, f.
Bulbinella Hookeri Benth.—B,E,P,Z. LWSubp, p.
Arthropodium candidum Raoul.—LWTemp, STA, ff.
Herpolirion novae-zelandiae Hook. f.—W,X.

Iridaceae.

Libertia ixioides Spreng.—B,E,P,Z. WTemp, ATA, rr.
L. (undescribed sp.).—B,E,Z. WTemp, STA, rr.
L. pulchella Spreng.—B,E,P,Z. LCTemp, ATA, pp; UWTemp, Ruamahanga and Mangatainoka basins, c.

Orchidaceae.

Dendrobium Cunninghamii Lindl.—B,E,P,Z. WTemp, ATA, ep, c.
Bulbophyllum pygmaeum Lindl.—B,E,Z. LWTemp, ATA, ep, rr.
Earina muconata Lindl.—B,E,P,Z. LWTemp, ATA, ep, rr.
E. autumnalis Hook. f.—A,B,E,Z. WTemp, ATA, ep, cc.
Sarochilus adversus Hook. f.—B,E,Z. LMTemp, ATA, ep, rr.
Thelymitra longifolia Forst. var.—B,E,Z. WTemp, STA, c.
T.l. var.—E,Z. WTemp, STA, r.
T. venosa R. Br.—B,E,Z. WTemp, STA, open pl., rr.
T. uniflora Hook. f.—B,P.Z. CTemp, ATA, open pl., c.
Orthoceras strictum R. Br.—A,E,Z. WTemp, ATA, rr.
Microtis unifolia Reichenbach.—B. WTemp, STA, r.
Prasophyllum Colensoi Hook. f.—B,E,P,Z. CTemp, ATA, bogs, f.
Pterostylis confertifolia Cockn. et Allan.—A,B,E,Z. UCTemp, ATA, r.
P. Banksii R. Br.—A,B,E,Z. LWTemp, STA, f.
P. graminea Hook. f.—A,B,E. WTemp, STA, r.
P. foliata Hook. f.—A,M—A!,E. WTemp, STA, r.
P. venosa Col.—E,M—To!,Z. UCTemp, LCSubp, NTA, ETA, WTA, rr.
P. trullifolia Hook. f.—E. LWTemp, STA, r–f.
P. barbata Lindl.—E. LWTemp, STA, r.
Acianthus Sinclairii Hook f.—E. LWTemp, STA, r.
Cyrtostylis oblonga Hook. f.—A,E. LWTemp, STA, r.
Calochilus paludosus R. Br.—W—Atkinson,X.
Lyperanthus antarcticus Hook. f.—E,P,W,Z. UCTemp, ATA, f.
Caladenia minor Hook. f.—E,W. LWTemp, STA, rr.
C. bifolia Hook. f.—E,P,W,Z. UCTemp, ATA, c.
Chiloglottis cornuta Hook. f.—A,B,E,W. UWTemp, LCTemp, STA, rr.
Adenochilus gracilis Hook. f.—E,Z. UWTemp, Ruamahanga basin (NTA), ff.
Corysanthes oblonga Hook. f.—B,W—Phillips. LWTemp, STA, r.
C. rivularis Hook. f.—E. c. 400 m., Mangatainoka R., r.
C. rotundifolia Hook, f.—B. LWTemp, STA, r.
C. triloba Hook. f.—B,E,P,Z. LCTemp, ATA, ff.
C. macrantha Hook. f.—B,E,Z. WTemp, ATA, c.
Gastrodia sesamoides R. Br.—A,W,X.
G. Cunninghamii Hook. f.—B,E,P,Z. LWTemp, ATA, ff.

SPERMATOPHYTA—DICOTYLEDONAE.

Piperaceae.

Macropiper excelsum Miq.—A,B,E,Z. 0–100 m., NTA, STA, pp.
Peperomia Urvilleana A. Rich.—E,Z. c. 20 m. Tokomaru G., nr. Mt. Wainui, r.

Fagaceae.

Nothofagus Menziesii Oerst.—B,E,P,Z. UWTemp, Mangahou V. (NTA), ETA, cc; CTemp, ETA, WTA, STA, dd.
N. fusca Oerst.—B,E,P,Z. UWTemp, LCTemp, ATA, p–dd, but absent north of Mt. Mairakau.
N. truncata Cockayne.—B.E,Z, WTemp, ETA, f; STA, pp–dd.
N. Solandri Oerst.—B,E,P,Z. WTemp, ETA, ff; STA, pp–d; nr. Manawatu G. (NTA), r.
N. cliffortioides Oerst.—A,X.
N. Solandri × *truncata* = × *N. apiculata* (?).—B,E,P,Z. cc.

Moraceae.

Paratrophis microphylla Cockayne.—B,E,Z. LWTemp, NTA, ETA, STA, r.
P. opaca Britton.—M—A!,B,E,Z. LWTemp, STA, r; west slopes of Mt. Wainui, cc.

Urticaceae.

Urtica ferox Forst. f.—B,E,Z. LWTemp, NTA, STA, ff.
U. incisa Poir.—B,P,Z. LWTemp, ATA, ff.
Elatostema rugosum A. Cunn.—E,Z. LWTemp, NTA, water, pp.
Parietaria debilis Forst. f.—B,Z. LWTemp, NTA, STA, ff.
Ausaralina pusilla Gaud.—B,Z. LWTemp, Manawatu G., r; STA, r.

Proteaceae.

Knightia excelsa R. Br.—A,B,E,Z. WTemp, NTA, STA, cc; WTA, ETA, r.

Santalaceae.

Mida salicifolia A. Cunn.—E,Z. WTemp, NTA, p; WTA, rr.
M. myrtifolia A. Cunn.—B,Z. LWTemp, STA, r; Mt. Wainui, f.

Loranthaceae.

Elytranthe Colensoi Engl.—P,B. WTemp, ETA, STA, r.
E. tetrapetala Engl.—A,E,Z. WTemp, ETA, STA, f.
E. flavida Engl.—B. LWTemp, STA, r.
Loranthus micranthus Hook. f.—B,Z. LWTemp, ETA, STA, rr, c. 800 m., Mt. Mitre (ETA), single sp.
Tupeia antarctica Cham.—A,X.
Korthalsella salicornioides Van.—B,E,Z. LWTemp, STA, ff.
K. Lindsayi Engl.—B. LWTemp, Wainui-o-mata V., r.

Balanophoraceae.

Dactylanthus Taylori Hook. f.—A,M—A!,X.

Polygonaceae.

Muehlenbeckia australis Meissn.—A,B,E,Z. LWTemp, ATA, river, c.
M. Astoni Petrie.—B. nr. C. Turakirae, r.
M. complexa grandiflora H. Carse.—A,B,Z. LWTemp, ATA, c.
M.c. trilobata Cheesem.—B. LWTemp, STA, r.
M.c. microphylla Cockayne.—B. LWTemp, STA, coastal cliffs c.

Aizoaceae.

Mesembryanthemum australe Sol.—B,Z. Cliffs at C. Turakirae, f.
Tetragonia trigyna Banks et Sol.—B,E. LWTemp, nr. C. Turakirae, rr.

Portulacaceae

Claytonia australasica Hook. f.—B,C,E,P,W,Z. LWSubp, screes, cc.

Montia fontana Linn.—E,Z. LWSubp, water, pp.

Caryophyllaceae.

Stellaria parviflora Banks et Sol.—B,P,Z. Temp, NTA, ETA, STA, rr.

Colobanthus crassifolius Hook. f.—A,W,Z. LWSubsp, screes, f.

C. Muelleri T. Kirk.—B. Coastal cliffs, Cook Str, f.

Ranunculaceae.

Clematis indivisa Willd.—B,E,P,Z. WTemp, ATA, c.

C. hexasepala DC.—B,P. LWTemp, STA, r.

C. Colensoi rutaefolia Hook f.—B,E,Z. LWTemp, NTA, STA, rr.

C. foetida Raoul.—B,Z.—LWTemp, NTA, STA, f.

Ranunculus insignis Hook f.—B,E,K,M,P,W,Z. UCTemp, LWSubp, ATA, water, p.

R. Monroi Hook. f.—K—Bu !,A—Bu,W—Bu,M—Bu !,X. = epharmone of *R. insignis*?

R. geraniifolius Hook. f.—K—Bu !—Arnold !,M—Bu !—Arn !,-B,E,P,Z.

R.g. var. (deeply trilobed lvs.).—E,Z. LWSubp, herb, c.

R.g. var. (deeply several times trilobed).—E,Z. LWSubp, bog, c.

R. tenuicaulis Cheesem.—C,P,W—C,M—oo !,X?

R. hirtus Banks et Sol.—B,E,P,Z. CTemp, ATA, ff.

R. lappaceous Smith.—E,Z. UCTemp, LWSubp, Mt. Waingawa, Mt. Arête, Park V., ff–c.

R. rivularis Banks et Sol.—A,B,Z. LWTemp, ATA, r.

Caltha novae-zealandiae Hook. f.—B,E,M—oo !,P,Z. LCSubp, herb, bog, p.

Winteraceae.

Pseudowintera axillaris Dandy.—B,E,P,Z. WTemp, ATA, c–p.

P. colorata Dandy.—B,E,P,Z. LCTemp, ATA, pp.

Monimiaceae.

Hedycarya arborea Forst.—B,E,P,Z. WTemp, ATA, pp.

Laurelia novae-zealandiae A. Cunn.—B,E,P,Z. LWTemp, ff.

Lauraceae.

Beilschmiedia tawa Hook. f.—B,E,P,Z. WTemp, ATA, pp–dd.

Cruciferae.

Cardamine heterophylla O. E. Schultz.—E,P,Z. LWSubp, screes, c.

C.h. var—B,Z. LWTemp, ATA, ff.

Lepidium oleraceum acutidentatum T. Kirk.—B. Cliffs, C. Turakirae, ff.

Droseraceae.

Drosera stenopetala Hook. f.—B,E,M—oo !,P,W,Z. UCTemp, LWSubp, bog, cc.

D. arcturi Hook.—M—Colenso !—A !—Olson !,X.

D. spathulata Lab.—P(?),X.

D. binata Lab.—A,E. LWTemp, STA, r; Otaki G. (WTA), r.

D. auriculata Backh.—A,E. LWTemp, STA, in manuka, ff; Otaki G. (WTA), r.

Crassulaceae.

Tillaea moschata DC.—B. LWTemp, Mt. Matthews (STA), r.
T. debilis Col.—A,X.

Saxifragaceae.

Carpodetus serratus Forst.—B,E,P,Z. LWTemp, ATA, c.

Pittosporaceae.

Pittosporum tenuifolium Banks et Sol.—B,E,P,Z. WTemp, ATA, rr, exc. STA, c.
P. Colensoi Hook. f.—E. WTemp, Ruamahanga upper basin, r.
P. rigidum Hook. f.—K—Arnold!—Tr!,M—oo!,B,E,P,W,Z. CTemp, ATA, ff–cc.
P. cornifolium A. Cunn.—B,E,Z.. LWTemp, ATA, f.
P. eugenioides A. Cunn.—A,B,E,Z. LWTemp, NTA, WTA, r; ETA, STA, ff.

Cunoniaceae.

Weinmannia racemosa Linn. f.—B,E,P,Z. WTemp, LCTemp, pp–dd.

Rosaceae.

Rubus australis Forst. f (not as in Cheeseman, 1925).—B,E,P,Z. LWTemp, ETA, STA, r.
R. cissoides A. Cunn. (not as in Cheeseman, 1925).—B,E,P,Z. WTemp, LCTemp, ATA ff.
R. schmidelioides A. Cunn (not as in Cheeseman, 1925).—B,E,Z. LWTemp, ATA, r.
R. squarrosus Fritsch.—B,Z. Rocks at Manawatu G. and nr. C. Turakirae, r.
Geum parviflorum Sm.—B,E,P,W,Z. UCTemp, ATA, water, rr; LWSubp, scree, r.
Acaena novae-zealandiae T. Kirk.—P,X.
A. sanguisorbae Vahl.—B,E,P,Z. WTemp, ATA, river, pp.

Leguminosae.

Carmichaelia australis R. Br.—Z. 0–300 m., Mt. Wainui, c.
C. odorata Col.—B,E,P,W,Z. WTemp, ATA, gorges, pp.
C. flagelliformis Col.—B,E,P,Z. LWTemp, ATA, rocks, ff.
Edwardsia microphylla Salisb.—B,E,P,Z. LWTemp, NTA, STA, ff; ETA, rr; WTA, r.

Geraniaceae.

Geranium microphyllum Hook. f.—P,Z. UCTemp, ATA, r; Mt. Hector, 1500 m., r.

Oxalidaceae.

Oxalis corniculata Linn.—B,Z. LWTemp, STA, riverbed, ff. Probably introduced.
O. lactea Hook.—B,E,P,Z. LWSubp, water, c; WTemp, ETA, WTA, STA, riverbed, f.

Linaceae.

Linum monogynum Forst. f.—B,E,Z. Coastal cliffs, rr.

Rutaceae.

Melicope ternata Forst.—B,E,Z. 0–300 m., Mt. Wainui, c; nr. C. Turakirae, f.
M. simplex A. Cunn.—B,E,P,Z. LWTemp, ATA, rr; nr. Manawatu G., Mt. Wainui, c.
M. simplex × *ternata*.—B.

Meliaceae.

Dysoxylum spectabile Hook. f.—B,E,P,Z. LWTemp, Western slopes of Mt. Wainui, pp.

Callitrichaceae.

Callitriche verna Linn.—Z. LWTemp, NTA, ff.

Coriariaceae.

Coriaria arborea Lindsay.—B,E,P,Z. LWTemp, ATA, c.
C. sarmentosa Forst. f.—B,Z. nr. C. Turakirae, r.
C. lurida, T. Kirk.—B,E,P,Z. UCTemp, ATA, screes, water, ff.
C. angustissima Hook f.—A,M—A! = *C. lurida?*

Corynocarpaceae.

Corynocarpus laevigatus Forst.—B,E,Z. 0–50 m., Muku-muku basin, c.

Icacinaceae.

Pennantia corymbosa Forst.—B,E,P,Z. LWTemp, ATA, rr–f.

Sapindaceae.

Alectryon excelsum Gaertn.—B,E,P,Z. 0–50 m., NTA, STA, ff.
Dodonaea viscosa Jacq.—B,E,Z. c. 80 m., Manawatu G., Wairongomai R., Silverstream (STA), r.

Rhamnaceae.

Discaria toumatou Raoul.—E,Z. nr. C. Turikirae, r.

Elaeocarpaceae.

Elaeocarpus dentatus Vahl.—B,E,P,Z. WTemp, ATA, ff.
E. Hookerianus Raoul.—B,E,P,Z. WTemp, LCTemp, ATA, r.
E. dentatus × *Hookerianus.*—B,E.
Aristotelia serrata W. R. B. Oliver.—B,E,P,Z. WTemp, ATA, pp; LCTemp, ATA, f.
A. fruticosa Hook. f.—A,B,E,Z. CTemp, ATA, f.
A. fruticosa × *serrata.*—Z.

Malvaceae.

Plagianthus divaricatus Forst.—B. 0–150 m., nr. C. Turakirae, r.
P. betulinus A. Cunn.—A,B,E,Z, 0–150 m., NTA, STA, f.
P. betulinus × *divaricatus.*—B.
Hoheria sexstylosa Col.—B,E,P,Z.
H.s. var.—E,Z. WTemp, ATA, water, ff.
H.s. var.—E,Z. UWTemp, CTemp, ATA, water, c; Waiohine-iti V., pp.

Violaceae.

Viola filicaulis Hook. f.—B,E,P,Z. CTemp, ATA, c.
V. Cunninghamii Hook. f.—B. CTemp, Mt. Matthews (STA), r.
Melicytus ramiflorus Forst.—B,E,P,Z. WTemp, ATA, cc-pp.
M. lanceolatus Hook. f.—B,E,P,W,Z. UWTemp, LCTemp, NTA, ETA, STA, rr-c.
M. micranthus Hook. f.—B. nr. Day's Bay (STA), r.
M. lanceolatus × *ramiflorus.*—B,Z.
Hymenanthera crassifolia Hook. f.—B,E. nr. C. Turakirae, f.
H. obovata T. Kirk.—B.E. nr. C. Turakirae, r.

Passifloraceae.

Tetrapathaea tetrandra Cheesem.—B.Z. c. 100 m., Manawatu G., Wairongomai basin, Mt. Wainui, f.

Thymelaeaceae.

Pimelea longifolia Banks et Sol.—A,B,E,W,Z. UCTemp, ATA, pp.

P. gnidia Willd.—P,M—P,W. = *P. longifolia*?; B,E,Z. UWTemp, on ridges nr. Mt. Matthews (STA), rr.

Drapetes Dieffenbachii Hook.—B,E,P,Z. LWSubp, c.

Myrtaceae.

Leptospermum scoparium Forst.—B,E,P,Z. WTemp, NTA, ETA, STA, r–ff.

L. ericoides A. Rich.—B,Z. LWTemp, Manawatu G., Muku-muku R., rr.

Metrosideros scandens Druce.—B,E,P,Z. WTemp, ATA, cc.

M. umbellata Cav. (?) var.—B,E,Z. LWTemp, NTA, ETA, STA, r.

M. carminea W. R. B. Oliver (=*M. diffusa* Sm.).—Bu, K—Mantell!X.

M. diffusa (Forst.) W. R. B. Oliver.—B,E,P,Z. LWTemp, NTA, STA, ff.

M. Colensoi Hook. f.—A,Z. LWTemp, NTA, STA, r.

M. robusta A. Cunn.—B,E,P,Z. WTemp, NTA, WTA, p–d; ETA, STA, rr–ff.

M. perforata A. Rich.—B,E,P,Z. LWTemp, ATA, f; STA, c.

Myrtus bullata Sol.—B,E,P,Z. LWTemp, ATA, r–ff.

M. obcordata Hook. f.—A,B,E. LWTemp, STA, r.

M. bullata × *obcordata*.—B.

M. pedunculata Hook. f.—B,E,P,Z. UWTemp, LCTemp, ATA, c.

Eugenia maire A. Cunn.—A,B,E,Z. LWTemp, ATA, r.

Onagraceae.

Epilobium pallidiflorum Sd.—A,X.

E. Billardierianum Ser.—B. LWTemp, Muku-muku basin (STA), r.

E. erectum Petrie.—B,P,Z. LWTemp, ATA, r.

E. junceum Soland.—B,P,Z. LWTemp, ATA, river, ff.

E. pubens A. Rich.—B,P,Z. WTemp, ATA, water, ff.

E. tenuipes Hook. f.—C,M—C,P,W—C,Z. Mangaterera R. (ETA), STA, r.

E. Hectori Haussk.—P?,M—P!X.

E. alsinoides A. Cunn.—B,P,Z. WTemp, ATA, r.

E. Cockaynianum Petrie.—A,B,K,M—oo!,W,Z. UCTemp, ATA, f.

E. chloraefolium Haussk.—A,B,K—Arnold,W,Z. UCTemp, ATA, rr.

E. insulare Haussk.—B,P. C. 50 m., L. Ponui (STA), r.

E. rotundifolium Forst. f.—B,P,Z. LWTemp, ATA, f.

E. linnaeoides Hook. f.—B,E,K—Bu,M—Bu—P,P,W—Bu,Z. CTemp, ATA, rr.

E. nummularifolium R. Cunn.—B,Z. LWTemp, ATA, r.

E. pedunculare A. Cunn.—B,E,P,Z. CTemp, ATA, c.

E. macropus Hook.—M—Bu,Z. LWSubp, ff.

E. gracilipes T. Kirk.—P?—K,W—P,X.

E. microphyllum A. Rich.—B,K!,M—K,W—K,Z. LWTemp, STA, f.

E. glabellum Forst. f.—B,E,K,P,Z. CTemp, LWSubp, ATA, water, cc.
Fuchsia excorticata Linn. f.—B,E,P,Z. WTemp, LCTemp, ATA, p.
F. perscandens Ckne.—B. c. 50 m., Muku-muku R., r.

Haloragidaceae.

Haloragis erecta Schindler.—B,Z. LWTemp, ATA, r.
H. depressa Walp.—Z. c. 200 m., Mangatainoka R., river.
Myriophyllum propinquum A. Cunn.—Z. LWTemp, ETA, STA, river flats, r.
Gunnera monoica albocarpa T. Kirk.—B,Z. WTemp, STA, c.
G. strigosa Col.—B,E,P,Z. WTemp, ATA, water, p.

Araliaceae.

Nothopanax simplex Seem.—B,E,P,Z. CTemp, ATA, f.
N. Edgerleyi Harms.—B,E,P,Z. WTemp, ATA, f.
N. anomalum Seem.—B,E,P,Z. UWTemp, ATA, r; Orongorongo R., Ruamahanga R., north of Mt. Marima, f.
N. Sinclairii Seem.—B,E,M—P,P,Z. LCTemp, ATA, c.
N. Colensoi Seem (5-foliate).—B,E,K,P,Z. CTemp, ATA, pp.
N.c. (3-foliate).—E,Z. c. 1100 m., west slope of Mt. Jumbo, r.
N. arboreum Seem.—B,E,P,Z. WTemp, ATA, pp.
Schefflera digitata Forst.—B.E,P,Z. WTemp, ATA, pp.
Pseudopanax crassifolium C. Koch.—B,E,P,Z. WTemp, NTA, STA, f; ETA, WTA, r.
P. ferox T. Kirk.—B. nr. C. Turakirae, r.

Umbelliferae.

Hydrocotyle elongata A. Cunn.—B,P,Z. WTemp, ATA, rr.
H. dissecta Hook. f.—P,X.
H. americana Linn.—B. LWTemp, STA, rr.
H. novae-zealandiae D.C.—P,X,
H. moschata Forst. f.—B,Z. LWTemp, ATA, ff.
H. centella uniflora Nanufeldt.—B,Z. c. 500 m., Mt. Matthews (STA), r.
Schizeilema trifoliatum Domin.—B,M—P,Z. WTemp, ATA, river, rr; Mitre Flats, pp.
S. nitens Domin.—A?,X. = *S. trifoliatum?*
S. hydrocotyloides Domin.—M—To!,Z. LWSubp, screes, water, c; c. 900 m., Park V., f.
Oreomyrrhis andicola Endl.—B,E,P,Z. LWSubp, herb, cc; CTemp, water, f.
Aciphylla Colensoi conspicua T. Kirk.—B,E,P,Z. LWSubp, p.
A. squarrosa Forst.—B,E,P,Z. CTemp, ATA, water, ff.
A. Colensoi × *squarrosa.*—E.
A. intermedia Petrie.—A(1914),P(1912),M—oo!E,Z. LWSubp, rr.
A. Monroi Hook f.—P,W—P,X. = *A. intermedia.*
A. Lyallii Hook. f.—A?,X. = *A. intermedia?*
A. (undescribed sp.?).—Z. LWSubp, Mt. Mitre, Mt. Bannister, Mt. Waingawa, screes, ff.
Anisotome dissecta Cockayne.—Bu(*Ligusticum Lyallii*), K—Arnold!—Bu!,M—oo!,B,E,P,W,Z. LWSubp, herb, p-d.
A. aromatica Hook. f.—B,E,P,Z. LWSubp, fell, screes, p.
Angelica montana Cockayne.—K,X.

Cornaceae.

Griselinia lucida Forst. f.—B,E,Z. LWTemp, ATA, f.
G. littoralis Raoul.—B,E,P,Z. WTemp, LCTemp, ATA, c–pp.

Ericaceae.

Gaultheria antipoda Forst. f.—B,E,P,Z. WTemp, NTA, WTA, r; ETA, STA, f–c.
G. depressa Hook. f.—B,E,P,Z. UCTemp, ATA, f.
G. rupestris R. Br.—B,E,P,Z. CTemp, ATA, scrub, c.
G. antipoda × *rupestris*.—B,E,Z.

Epacridaceae.

Pentachondra pumila R. Br.—B,E,P,Z. LWSubp, herb, fell, pp; UCTemp, f.
Cyathodes acerosa R. Br.—B,E,P,Z. WTemp, ETA, STA, c.
C. empetrifolia Hook. f.—B,E,P,Z. CTemp, ATA, bog, ff.
C. Colensoi Hook. f.—M—A!,W,X.
C. pumila Hook. f.—W,X.
Leucopogon fasciculatus A. Rich.—B,E,P,Z. WTemp, NTA, rr; ETA, STA, c.
L. Fraseri A. Cunn.—B,E. nr. C. Turakirae, r.
Dracophyllum longifolium R. Br.—M—Bu!P!, Oliver (1928),P, X. Oliver's specimen so labelled in the Dominion Museum is juvenile *D. Urvilleanum*.
D. Urvilleanum A. Rich.—B,E,M,Oliver(1928),P,W,Z. CTemp, ATA (UCTemp, cc–dd; LCTemp, rr–c).
D.U. montanum Cheesem.—M,X. = epharmone of *D. Urvilleanum*?
D. uniflorum Hook. f.—P,W,X. = epharmone of *D. rosmarinifolium*?
D. rosmarinifolium R. Br.—B,E,M—Bu!—P!,P,W,Z. LWSubp, pp.

Myrsinaceae.

Suttonia salicina Hook. f.—B,E,P,Z. WTemp, ATA, f; LCTemp, ATA, pp.
S. australis A. Rich.—B,E,P,Z. LWTemp, ATA, rr.
S. divaricata Hook. f.—B,E,P,Z. CTemp, ATA, cc.
S. nummularia Hook f.—C,E,M—oo!,P,W,Z. LWSubp, f.

Oleaceae.

Olea Cunninghamii Hook. f.—A,B,E. WTemp, STA, r.
O. lanceolata Hook. f.—A,B,Z. LWTemp, ATA, rr.
O. montana Hook. f.—B,E,M—oo!,P,Z. WTemp, STA, r.

Loganiaceae.

Geniostoma ligustrifolium A. Cunn.—B,E,Z. WTemp, ATA, r–f.

Gentianaceae.

Gentiana Grisebachii Hook. f.—A,B,Bu,E,M—Bu!,W,Z. CTemp, ATA, c.
G. patula Cheesem.—M—P!—To!,P,W,X. = epharmone of *G. bellidifolia*?
G. bellidifolia Hook f.—B,E,P,W,Z. CTemp, LWSubp, ATA, c.
G. pleurogynoides Griseb. as in Hooker, 1864.—Bu,X.
Liparophyllum Gunnii Hook. f.—B,E,M—P!—A!,P,W,Z. LC-Subp, bog, cc.

Apocynaceae.

Parsonsia heterophylla A. Cunn.—B,E,P,Z. WTemp, ATA, water, rr.
P. capsularis R. Br.—B,E,P,Z. LWTemp, ATA, water, r.
P. capsularis × *heterophylla.*—B,Z.

Convolvulaceae.

Calystegia tuguriorum R. Br.—B,Z. 0–80 m., nr. Manawatu G., Muku-muku R., f.
Dichondra repens Forst.—B,Z. c. 100 m., nr. C. Turakirae, r.

Boraginaceae.

Myosotis Forsteri Lehm.—B,E,Z. Temp, ATA, water, rr.
M. Astoni Cheesem.—A,M—To!—A!,W,X. (Mt. Holdsworth).

Solanaceae.

Solanum aviculare Forst. f.—A,B,E,Z. LWTemp, NTA, STA, rr.

Scrophulariaceae.

Jovellana repens Kranzl.—B,C,E,M—C—P(?),W,Z. WTemp, NTA, r; STA, f.
Mazus radicans Cheesem.—Bu,W—Colenso,X.
Hebe salicifolia Pennell.—B,E,P,Z. Temp, ATA, water, pp.. There are a number of distinct but interhybridising jordanons. The following is only an approximate summary.
H.s. Atkinsonii Cockayne.—B,E,Z. LWTemp, STA, f–c.
H.s. longiracemosa Cockayne.—Z. LWTemp, NTA, c.
H.s. angustissima Cockayne.—E,Z. WTemp, NTA, WTA, f–c.
H.s. stricta Hook. f.—E,Z. WTemp, ETA, c.
H.s. (?) paludosa Cockayne.—E,Z. CTemp, ATA, cc.
H.s. var.—E,Z. Manawatu G., Otaki G., rocks, c.
H. parviflora Ckn. et Allan.—B,E,Z. LWTemp, STA, f.
H. laevis Ckn. et Allan.—B,Bu,P,W,M—Bu!—P,Z. c. 1200 m., Mt. Dennan, nr. Mt. Matthews, r.
H. evenosa Ckn. et Allan.—B,E,M—P!—A!,Z. CTemp, ATA, ff–cc.
H. buxifolia Ckn. et Allan.—B,E,M,P,W,Z. UCTemp, WTA, ETA, STA, f.
H. Astoni Ckn. et Allan.—B,Bu*(V. tetragona)*,E,M,P,W,Z. LW-Subp, cc.
Veronica catarractae Forst. f.—A,B,E,M,P,W,Z.
V.c. lanceolata Hook. f.—B,E,Z. LWTemp, NTA, ETA, STA, water, c–p; WTA, r.
V.c. diffusa Hook. f.—B,E,Z. UWTemp, C Temp, ATA, rocks, c–p.
V. Lyallii Hook. f.—B,Z. LWTemp, Manawatu G., Muku-muku R., r.
Ourisia macrophylla Hook.—B,E,P,Z. CTemp, ATA, water, f.
O.m. var (smaller than the preceding).—B,E,Z. CTemp, ETA, STA, water, f.
O. Colensoi Hook. f.—B,M—P!,P,W,Z. CTemp, STA, water, rr.
O. caespitosa Hook. f.—E,M—oo!,P,W,Z. LWSubp, r.
Euphrasia cuneata Forst. f.—B,E,P,Z. CTemp, ATA, scrub, p.

E. revoluta Hook. f.—B,E,M—Bu!—P!,P,W,Z. CWSubp, herb, f.
E. zealandica Wettst.—A,M—P—A!,W,X. = epharmone of *E. revoluta?*

Gesneriaceae.

Rhabdothamnus Solandri A. Cunn.—B,Z. LWTemp, NTA, STA, r.

Myoporaceae.

Myoporum laetum Forst. f.—B,E,Z. Manawatu G., west slopes of Mt. Wainui, cliffs along Cook Str., cc.

Plantaginaceae.

Plantago Raoulli Decne.—A,B,P,Z. WTemp, STA, r.
P. Brownii Rapin.—A,B,E,M—oo!,W—Bu,Z. LWSubp, cc.
P. lanigera Hook. f.—E,Z. LWSubp, Mt. Arête and surrounding peaks, f.
P. Brownii × *lanigera.*—Z.
P. uniflora Hook. f.—E,M—oo!P,W,Z. LWSubp, bog, ff.

Rubiaceae.

Coprosma australis Robinson.—B,E,O,P,Z. WTemp, LCTemp, ATA, cc.
C. lucida Forst. f.—B,E,O,P,Z. WTemp, LCTemp, ATA, ff.
C. retusa Hook. f.—B,E,O,Z. Coastal cliffs, Cook Str. and Mt. Wainui.
C. robusta Raoul.—B,E,P,Z. WTemp, ATA, rr–ff.
C. tenuifolia Cheesem.—Z. WTemp, nr. Manawatu G., upper Ruamahanga basin (NTA), r.
C. rotundifolia A. Cunn.—B,E,O,Z. LWTemp, NTA, STA, ff.
C. areolata Cheesem.—B,E,Z. 0–50 m., nr. Cook Str., r.
C. tenuicaulis Hook. f.—B,E,Z. LWTemp, STA, f.
C. rhamnoides A. Cunn.—B,E,O,P,Z. WTemp, NTA, ETA, STA, rr–cc; WTA, r.
C. parviflora Hook. f.—A,B,E,O,Z. CTemp, ATA, cc.
C.p. (recurving branches).—E,Z. ETA., f., Mt. Waiopehu.
C.p. (fruit crimson).—Z. NTA, c.
C.p. (fruit white).—B,E,Z. ATA, f–cc.
C.p. (fruit yellow).—B,Z. STA, rr.
× *C. Buchanani* T. Kirk.—B. nr. C. Turakirae, r.
C. crassifolia Col.—B. nr. C. Turakirae, r.
C. rigida Cheesem.—B. c. 50 m., Mt. Matthews, r.
C. rubra Petrie.—A,B,M—A!,W—P. LWTemp, ETA, STA, r.
C. brunnea Cockayne.—Z. c. 210 m., Mangatainoka, river, r.
C. rugosa Cheesem.—B,E,Z. CTemp, Park V., Mt. Dennen, nr. Mt. Matthews, Ruamahanga basin, r.
C. propinqua A. Cunn.—B,E,Z. LWTemp, nr. Cook Str., r.
C. propinqua × *robusta.*—B.
C. foetidissima Forst.—B,E,O,P,Z. CTemp, ATA, pp.
C. Colensoi Hook. f.—B,E,K—Budden!,M,O,P,W,Z. CTemp, ATA, pp.
C. Banksii Petrie.—B,E,M—Bu—P!,O,P,Z. WTemp, ETA, pp; NTA, STA, rr.
C. Colensoi × *Banksii.*—A(1927),O,Z. These are really two of the series of distinct varieties of the same species.

C. Colensoi × *foetidissima.*—Allan (1927), O, X.
C. Banksii × *foetidissima.*—Allan (1927), O, X.
C. pseudocuneata W. R. B. Oliver.—B,E,O,P,W,Z. CTemp, ATA, pp.
C. microcarpa Hook. f.—A,B,E,M—P !,O,W,Z. LWTemp, ETA, STA, rr.
C. depressa Col.—B,E,M—P !,O,P,W,Z. UCTemp, ATA, f.
C. repens Hook. f.—B,E,O,P,W,Z. LWSubp, herb, bog, pp.
Nertera depressa Banks et Sol.—P,Z. CTemp, ATA, f.
N. dichondraefolia Hook. f.—B,P,Z. WTemp, ATA, rr.
N. setulosa Hook. f.—B,Z. CTemp, ATA, rr–c.
Galium umbrosum Sol.—B. WTemp, STA, r.

Caprifoliaceae.

Alseuosmia macrophylla A. Cunn (?).—B,E,P,W—P,Z. WTemp, LCTemp, ATA, f–c.

Campanulaceae.

Pratia angulata Hook. f.—B,E,P,Z. WTemp, ATA, river, c.
P. perpusilla Hook. f.—Z. Low rocks, Manawatu Gorge, r.
Wahlenbergia gracilis Schrad.—A,B,E,Z. WTemp, ATA, water, r.
W. albomarginata Hook.—E,Z. LWSubp, ETA, r.

Stylidiaceae.

Donatia novae-zealandiae Hook. f.—A,B,M—To !,W—To !. LW-Subp, Field Pk., r.
Phyllachne Colensoi Berggr.—B,Bu,E,P,Z. LWSubp, fell, p.
Forstera Bidwillii Hook. f.—E,P(?),Z. UCTemp, LWSubp, ATA, bog, c.
F. tenella Hook. f.—P,X.

Compositae.

Lagenophora pumila Cheesem.—A,B,E,Z. WTemp, cleared forest, c.
L. petiolata Hook. f.—B,E,K,P,Z. WTemp, cleared forest, c.
Brachycome Sinclairii Hook. f.—E,K,Z. c. 900 m., Waiohine-iti V., rr.
Olearia Colensoi Hook. f.—B,Bu,E,K,M,P,W,Z. CTemp, ATA, pp–dd, LWSubp, water, f. There are two jordanons: one with purple flowers, the other with yellow.
O. arborescens Cockayne et R. M. Laing.—B,E,P,Z. CTemp, ATA, cc.
O. ilicifolia Hook. f.—Bu,E,Z. CTemp, ATA, rr.
O. rani Druce.—B,E,Z. WTemp, ATA, f–c.
O.r. var. (lvs. orbicular).—Z. LWTemp, Mt. Wainui, f.
O. lacunosa Hook. f.—B,Bu,E,K,M,oo !,P,W,Z. UCTemp, cc.
O. arborescens × *lacunosa.*—B,Bu,E,P,Z.
O. paniculata Cheesem.—B,E,Z. LWTemp, STA, r–f.
O. virgata Hook. f.—E,Z. LWTemp, NTA, r.
O. Solandri Hook f.—B,E,Z. LWTemp, STA, r.
Celmisia densiflora Hook. f.—Bu, K—Bu,X.
C. incana Hook. f.—K,M—Bu,W—Bu,X.
C. hieracifolia Hook. f.—A,B,E,C(?),M—A !—P !,P,Z. LWSubp, herb, cc.

C.h. oblonga T. Kirk.—B,E,Z. LWSubp, fell, bog, south of Mt. Hector, c.
C. spectabilis Hook. f.—B,E,P,W,Z. LWSubp, herb, pp–d.
C. *coriacea* Hook. f.—K—Bu,M—Bu,W—Bu,X.
C. gracilenta Hook. f.—A,B,E,Z. UCTemp, Mt. Kaipororo, Mt. Oriwa Lake-Hollow, p; ETA, r.
C. graminifolia Hook. f.—M—To!,X. = *C. gracilenta*?
C. hectori Hook. f.—Bu,K—Budden!,M—K,W—Budden,X.
Vittadinia australis A. Rich.—B,E,Z. WTemp, STA, f.
Gnaphalium Lyallii Hook. f.—B,K!,M—K,W—K,Z. WTemp, STA, rr.
G. trinerve Forst. F.—E,K!,M—K!,W—K,Z. c. 900 m., Park R., c.
G. keriense A. Cunn.—B,E,P,Z. WTemp, ATA, water, cc.
G. keriense × *Helichrysum bellidioides.*—B,Z.
G. subrigidum Col.—Z. LWTemp, NTA, calcareous mudstones, r.
G. Traversii Hook. f.—A,B,E,M—oo!,P,W,Z. CTemp, ATA, f.
G. luteo-album Linn.—A,B,E,Z. WTemp, water, rr.
G. japonicum Thunb.—Z. WTemp, ATA, river, r.
G. collinum Lab.—B,Z. WTemp, ATA, river, rr.
Raoulia rubra Buch.—B,E,Bu(1882),K,M—Bu!,P,W,Z. LW-Subp, fell, rocks, pp–dd.
R. mammillaris Hook. f.—Bu,X. = *R. rubra.*
R. Loganii Cheesem. — A,B,Bu(1882),E,M—oo!,P,W,Z. LW-Subp, r.
R. grandiflora Hook. f.—B,E,P,W,Z. LWSubp, fell, cc.
R.g. fasciculata Cheesem.—Bu(1877),M—Tr!,K—Tr!,W—Tr!,X.
R. glabra Hook. f.—A,B,E,K,M—Bu—A!,W,Z. WTemp, STA, rr.
R. australis Hook. f.—B,E,Z. nr. Cook St., screes, p.
R. tenuicaulis Hook. f.—B,E,Z. WTemp, ATA, river, c.
R.t. pusilla T. Kirk.—B,E,K,Z. WTemp, ATA, river, p.
Leucogenes leontopodium Beauverd.—B,E,K.Budden!—To!,M,P, W,Z. LWSubp, herb, pp.
Helichrysum bellidioides Willd.—A,B,E,P,Z. CTemp, water, c; LWSubp, herb, f.
H. filicaule Hook. f.—B,P,Z. WTemp, ATA, open pl., r.
H. glomeratum Benth. et Hook. f.—A,B,E,Z. NTA, ETA, STA, f–c.
Cassinia leptophylla R. Br.—B,E,Z. WTemp, ETA, STA, f. Possibly introduced.
C. Vauvilliersii Hook. f.—B,E,Z. LWSubp, ETA, rr; east slope of Mt. Waingawa, c. 800 m.
Craspedia uniflora Forst. f.—A,B,E,Z. WTemp, ETA, STA, r-rr.
Cotula pyrethrifolia Hook. f.—B,M—A!—P!,P,Z. LWSubp, water, rr.
C. squalida Hook. f.—B,Z. LWTemp, ATA, river, r.
Abrotanella pusilla Hook. f.—B,E,M—oo!,P,W,Z. LWSubp, bog, cc.
Erechtites prenanthoides DC.—A,B,Z. WTemp, ATA, rr.
E. arguata DC.—A,Z. LWTemp, NTA, ETA, r. Introduced?
E. scaberula Hook. f.—B. LWTemp, nr. Mt. Matthews (STA), r.

E. quadridentata DC.—Z. c. 80 m., Manawatu G., rocks, r.
Brachyglottis repanda Forst.—B,E,P,Z. WTemp, ATA, water, pp.
Senecio lagopus Raoul.—B,E,P,Z. LWSubp, water, cc.
S. lautus Forst. f.—E. c. 400 m., Cross Ck. and Tapokopoko Ck., STA, r. Probably introduced.
S. Solandri Allan (1935).—B,E,P,Z. CTemp, ATA, water, cc.
S. Kirkii Hook. f.—B,E,P,Z. WTemp, ATA, c; WTA, pp; LCTemp, f.
S. Greyi Hook. f.—B,E,Z. LWTemp, Muku-muku basin (STA), p.
S. Adamsii Cheesem.—M—To!,W,X. c. 1200 m., Mt. Holdsworth, only one specimen reported.
S. elaeagnifolius Hook. f.—B,E,P,Z. CTemp, ATA, c–pp.
S.e. var.—B,E,Z. CTemp, Mt. Matthews and nearby peaks, pp.
S. Bidwillii Hook f.—B,Bu,E,K—oo,P,Z. LWSubp, cc.

BRYOPHYTA—MUSCI.

V. D. Zotov and G. O. K. Sainsbury.

Unlike higher plants, mosses do not lend themselves readily to field identification on account of their small size. Since microscopic examination is necessary in the majority of cases, listing of species directly in the field as one traverses the country is practically impossible. Further, more rare and more minute species are easily missed unless a careful search is made for them. Considering the extent of the country covered and the nature of the species, it will be seen that the list must necessarily be somewhat incomplete and the information on the distribution rather meagre. It might be stated, however, that a number of representative localities in each area as determined for the higher plants was thoroughly examined. In all cases where only a few specimens were collected numbers are given in the list referring to the specimens deposited in the herbarium of the Plant Research Bureau. The arrangement of families is that of Dixon (Verdoorn, 1932), while that of genera and species is alphabetical.

Sphagnaceae.

Sphagnum irritans Warnst.—UCTemp, LWSubp, ATA.
S. Kirkii Warnst.—7138, Orongorongo R., c. 600 m.
S. linguaefolium Warnst.—7447, 7450, Mt. Hector, c. 1400 m.
S. otagoense Warnst.—Mt. Omega, c. 1100 m. (reported by L. B. Moore).
S. subbicolor Hampe.—6614, Mt. Oriwa, c. 900 m.

Andreaeaceae.

Andreaea acuminata Mitt.—7384, Mt. Hector, c. 1400 m.
A. nitida H. f. and W.—7668, 7651, Mt. Hector, c. 1400 m.
A. rupestris Hedw.—6669, Te Matawai Hut, also Field Hut, c. 900 m.; LWSubp.
A. subulata Harv.—7425, Mt. Hector, c. 1300 m.

Calomniaceae.

Calomnia laetum H. f. and W.—6858, Tiritea R., c. 400 m.

Dawsoniaceae.

Dawsonia superba Grev.—WTemp, ATA.

Analysis of the Distribution of Pteridophyta and Spermatophyta

| Belts | Areas | Frequencies. | Hymenophyllaceae | Cyatheaceae | Polypodiaceae | Gleicheniaceae | Schizaeaceae | Osmundaceae | Ophioglossaceae | Lycopodiaceae | Other families | Pteridophyta (total) | Pinaceae | Taxaceae | Pandanaceae | Naiadaceae | Gramineae | Cyperaceae | Palmae | Centrolepidaceae | Juncaceae | Liliaceae | Iridaceae | Orchidaceae | Other families | Monocotyledonae (total) | Piperaceae | Fagaceae | Moraceae | Urticaceae | Proteaceae | Santalaceae | Loranthaceae | Polygonaceae | Aizoaceae | Portulacaceae | Caryophyllaceae | Ranunculaceae | Winteraceae | Monimiaceae | Lauraceae | Cruciferae | Droseraceae | Crassulaceae | Saxifragaceae | Pittosporaceae | Cunoniaceae | Rosaceae | Leguminosae | Geraniaceae | Oxalidaceae | Linaceae | Rutaceae | Meliaceae | Callitrichaceae | Coriariaceae | Corynocarpaceae | Icacinaceae | Sapindaceae | Rhamnaceae | Elaeocarpaceae | Malvaceae | Violaceae | Passifloraceae | Thymelaeaceae | Myrtaceae | Onagraceae | Haloragidaceae | Araliaceae | Umbelliferae | Cornaceae | Ericaceae | Epacridaceae | Myrsinaceae | Oleaceae | Loganiaceae | Gentianaceae | Apocynaceae | Convolvulaceae | Boraginaceae | Solanaceae | Scrophulariaceae | Gesneriaceae | Myoporaceae | Plantaginaceae | Rubiaceae | Caprifoliaceae | Campanulaceae | Stylidiaceae | Compositae | Other families | Dicotyledonae (total) | Grand total |
|---|---|---

Polytrichaceae.

Catharinaea Muelleri Hampe and C. M.—9160, 9161, Ruamahanga R., c. 320 m.
Oligotrichum tenuirostre (Hook.) Jaeg.—LCTemp, ATA.
Psilopilum australe (H. f. and W.) Jaeg.—7392, nr. Field Hut, c. 1000 m.
P. Belli Broth.—6749, Mt. Hector, c. 1400 m. (coll. L. B. Moore).
P. crispulum (H. f. and W.) Jaeg.—LCTemp, ATA.
Pogonatum subulatum (Menz.) Brid.—4769, Tiritea R., c. 110 m.
Polytrichum commune Hedw.—6622, Mt. Oriwa, c. 900 m.
P. formosum Hedw.—nr. Alpha Hut, c. 1100 m. (reported by L. B. Moore).
P. juniperinum Willd.—WTemp, ATA.
Polytrichadelphus magellanicus Mitt.—Temp, ATA.

Fissidentaceae.

Fissidens adiantoides Hedw.—7593, nr. Field Hut, c. 850 m.
F. asplenioides (Sw.) Hedw.—LWTemp, ATA; 7593, Field Hut, c. 900 m.
F. campyloneurus C. M. and Beck.—6854, Tiritea R., c. 400 m.
F. dealbatus H. f. and W.—6869, etc., Tiritea R., c. 400 m.; 7536, nr. Field Hut, c. 850 m.
F. leptocladus C. M. and Rodway.—Manawatu Gorge, c. 150 m.
F. oblongifolius H. f. and W.—LWTemp, NTA.
F. pallidus H. f. and W.—7538, nr. Field Hut, c. 750 m.
F. rigidulus H. f. and W.—Temp, ATA.

Grimmiaceae.

Grimmia apocarpa Hedw.—7641, nr. Mt. Hector, c. 1200 m.; 7199, Wairongomai R., c. 500 m.
Rhacomitrium crispulum (H. f. and W.) H. f. and W.—UWTemp to LWSubp, ATA.
R. lanuginosum (Hedw.) Brid.—CTemp, LWSubp, ATA.
R. ptychophyllum Mitt.—7445, Mt. Hector, c. 1500 m.

Dicranaceae.

Blindia magellanica Sch. and C. M.—7437, Mt. Hector, c. 1300 m.
B. tenuifolia (H. f. and W.) Mitt.—7431, 7435, Mt. Hector, c. 1300 m.
Campylopodium euphorocladium (C. M.) Besch.—7395, 7435, nr. Field Hut, c. 1000 m.
Campylopus appressifolius Mitt.—6676, Te Matawai Hut, c. 900 m.
C. arboricola Card. and Dixon.—UWTemp, LCTemp, NTA, WTA.
C. clavatus (R. Br). H. f. and W.—UCTemp, LWSubp, WTA.
C. introflexus (Hedw.) Mitt.—WTemp, LCTemp, ATA.
C. torquatus Mitt.—LWTemp, NTA.
Ceratodon purpureus Brid.—Temp, LWSubp, ATA.
Dicranella sp.—7645, nr. Mt. Hector, c. 1300 m.
Dicranoloma Billardieri (Schwaegr.) Par.—Temp, ATA.
D. cylindropyxis (C. M.) Dixon.—Temp, ATA.
D. Menziesii (H. f. and W.) Par.—WTemp, LCTemp, ATA.
D.m. rigidum (H. f. and W.) Par.—WTemp, ATA.
D. plurisetum (C. M.) Dixon.—CTemp, ATA.

D. pungens (H. f. and W.) Par.—UWTemp to LWSubp, ATA.
D. robustum (H. f. and W.) Par.—UWTemp to LWSubp, ATA.
Distichium capillaceum (Sw.) Bry. eur.—nr. Mt. Hector, c. 1300 m. (reported by L. B. Moore).
Ditrichum elongatum (H. f. and W.) Mitt.—6960, Mt. Marima, c. 400 m.
D. flexifolium (Hook.) Hampe.—UWTemp, CTemp, NTA, WTA.
Holomitrium perichaetiale (Hook.) Brid.—9176, Ohau R., c. 200 m.

Dicnemonaceae.

Mesotus celatus Mitt.—7113, Mt. Mitre, c. 1200 m.
Dicnemon calycinum (Hook.) Schwaegr.—WTemp, ATA.
D. semicryptum C.M.—6897, Te Matawai Hut, c. 900 m.; 7627, 7635, Field Hut, c. 850 m.

Leucobryaceae.

Leucobryum candidum (Brid.) H. f. and W.—WTemp, LCTemp, ATA.

Pottiaceae.

Calyptopogon mnioides (Schwaegr.) Broth.—7185, Wairongomai R., c. 200 m.
Tortella calycina (Schaewgr.) Dixon.—9134, Akatarawa Saddle, c. 400 m.
Tortula princeps De Nots.—9145, Ohau-iti R., c. 300 m.
T. rubra Mitt.—nr. Mt. Hector, c. 1400 m. (reported by L. B. Moore).
Tridontium tasmanicum Hook.—WTemp, ATA; Mt. Hector, c. 1300 m.
Weisia viridula Hedw.—7051, Manawatu Gorge.

Orthotrichaceae.

Macromitrium eucalyptorum Hampe and C. M.—7201, 7220, Wairongomai R., c. 200 m.
M. gracile (Hook.) Schwaegr.—LWTemp, ATA.
M. longpipes (Hook.) Echwaegr.—WTemp, LCTemp, ATA.
M. prorepens (Hook.) Schwaegr.—7207, Ohau-iti R., c. 300 m.; 9152, Ruamahanga R., c. 320 m.
M. Pusillum Mitt.—7195, Wairongomai R., c. 200 m.
M. retusum H. f. and W.—UWTemp, NTA.
M. Weymouthii Broth.—9154, Ruamahanga R., c. 320 m.
Orthotrichum tasmanicum H. f. and W.—6666, Te Matawai, c. 900 m.
Schlotheimia Brownii Brid.—7276, Ohau-iti R., c. 300 m.
Ulota breviseta Malta.—9155, Ruamahanga R., c. 320 m.
U. laticiliata Malta.—7609, Field Hut, c. 850 m.
Zygodon intermedius B. and S.—6912, 6977, Mt. Marima, c. 400 m.

Splachnaceae.

Tayloria purpurescens (H. f. and W.) Broth.—7264, nr. Field Hut, c. 950 m.

Bryaceae.

Bryum blandum H. f. and W.—7422, etc., LWSubp.
B. chrysoneuron C. M.—UWTemp, LCTemp, ATA.
B. truncorum Brid.—WTemp, LCTemp, ATA.
Webera nutans Hedw.—7398, 7626, nr. Field Hut, c. 950 m.
W. tenuifolia (H. f. and W.) Jaeg.—17147, Manawatu Gorge, c. 150 m.

Leptostomaceae.

Leptostomum inclinans R. Br.—UWTemp, CTemp, ETA, STA.
L. macrocarpum (Hedw.) R. Br.—6915, Mt. Marima, c 200 m.; Wairongomai R., c. 50 m.

Mniaceae.

Mnium rostratum Schwaegr.—WTemp, STA.

Rhizogoniaceae.

Cryptopodium bartramioides (Hook.) Brid.—Temp, NTA, WTA.
Rhizogonium bifarium (Hook.) Schimp.—WTemp, LCTemp, ATA.
R. distichum (Sw.) Brid.—WTemp, LCTemp, ATA.
R. mnioides (Hook.) Schimp.—9125, Ruamahanga R., c. 320 m.; Akatarawa Saddle, c. 400 m.

Bartramiaceae.

Bartramia papillata H. f. and W.—LWSubp.
Breutelia elongata (H. f. and W.) Mitt.—LWSubp.
B. pendula (Hook.) Mitt.—UCTemp, LWSubp, ATA.
Conostomum australe Sw.—7427, Mt. Hector; Mt. Mitre; c. 1500 m.
C. pusillum H. f. and W.—LWSubp.
Philonotis australis (Mitt.) Jaeg.—Manawatu Gorge; Akatarawa Saddle; 7646, nr. Mt. Hector, c. 1300 m.
P. tenuis (Tayl.) Jaeg.—Manawatu G., Akatarawa Saddle; 7436, Mt. Hector, c. 1300 m.

Hypnodendraceae.

Hypnodendron arcuatum (Hedw.) Mitt.—WTemp, LCTemp, WTA, STA.
Mniodendron comatum (C. M.) Lind.—7257, Ohau-iti R., c. 300 m.; 7126, Orongorongo R., c, 600 m.
Sciadocladus Menziesii (Hook.) Lindb.—UWTemp, LCTemp, ATA.

Rhacopilaceae.

Rhacopilum strumiferum C.M.—LWTemp, ATA.

Cryphaeaceae.

Cryphaea dilatata H. f. and W.—6959, Mt. Marima, c. 200 m.; Akatarawa Saddle, c. 300 m.
C. tasmanica Mitt.—7289, Ohau-iti R., c. 400 m.; 9129, Ruamahanga R., c. 400 m.

Hedwigiaceae.

Rhacocarpus australis (Hampe.) Par.—UCTemp, LWSubp, ATA.

Ptychomniaceae.

Cladomnion ericoides (Hook.) H. f. and W.—WTemp, LCTemp, ATA.

Glypothecium alare Dix and Sainsb.—7526, nr. Field Hut, c. 850 m.

Ptychomnion aciculare (Brid.) Mitt.—Temp, LWSubp, ATA.

Cyrtopodaceae.

Cyrtopus setosus (Hedw.) Hook. f.—UWTemp, ATA.

Pterobryaceae.

Trachyloma planifolium (Hedw.) Brid.—UWTemp, ATA.

Meteoriaceae.

Papillaria amblyacis (C. M.) Jaeg.—7272, Ohau-iti R., c. 300 m.

P. crocea (Hampe.) Jaeg.—WTemp, NTA, STA.

P. filipendula (H. f. and W.) Jaeg.—7237, Wairongomai R., c. 100 m.

P. flavo-limbata (C. M. and Hampe.) Jaeg.—WTemp, LCTemp, ATA.

P. flexicaulis (Tayl.) Jaeg.—9230, Tokomaru R., c. 100 m.; LW Temp, STA.

Weymouthia cochlearifolia (Schwaegr.) Dix.—LCTemp, ATA.

W.c. Billardieri (Hampe.) Dixon.—UWTemp, LCTemp, ATA.

W.c.f. flagellifera.—WTemp, ATA.

W. mollis (Hedw.) Broth.—WTemp, LCTemp, ATA.

Phyllogoniaceae.

Orthorrhynchium elegans (H. f. and W.) Reichdt.—7106, Ohau-iti R., c. 300 m.

Neckeraceae.

Homalia falcifolia (H. f. and W.) H. f. and W.—WTemp, NTA.

H. pulchella H. f. and W.—WTemp, NTA.

Nekera hymenodonta C.M.—7242, Wairongomai R., c 200 m.

Porotrichum oblongifolium (H. f. and W.) Broth.—6878, Tiritea R., c. 400 m.

Thamnium latifolium (Bry. jav.) Par.—7454, 7462, Field Hut, c. 850 m.

T. pandum (H. f. and W.) Jaeg.—6898, Tiritea R., c. 150 m.; 7577, nr. Field Hut, c. 850 m.

Echinodiaceae.

Echinodium hispidum (H. f. and W.) Jaeg.—WTemp, ATA.

Lembophyllaceae.

Acrocladium auriculatum (Mont.) Mitt.—Temp, ATA.

Camptochaete angustata (Mitt.) Jaeg.—6899, Tiritea R., c. 150 m.; 7234, Wairongomai R., c. 150 m.

C. arbuscula (Hook.) Jaeg.—UWTemp, LCTemp, NTA; 7460, 7532, nr. Field Hut, c. 850 m.

C.a. deflexa (Wils.) Dix.—7258, Ohau-iti R., c. 300 m.

C. gracilis (H. f. and W.) Par.—WTemp, ATA; nr. Mt. Hector, c. 1400 m.

C. ramulosa (Mitt.) Jaeg.—7189, 7233, Wairongomai R., c. 50 m.; 9123, Ruamahanga R., c. 320 m.

Lembophyllum clandestinum (H. f. and W.) Lindb.—WTemp, LCTemp, ATA.

Hookeriaceae.

Bellia nervosa (H. f. and W.) Broth.—6976, Mt. Marima, c. 200 m.; 7548, etc., nr. Field Hut, c. 850 m.
Daltonia novae-zelandiae Mitt.—9155d, Ruamahanga R., c. 320 m.
Distichophyllum amblyophyllum (H. f. and W.) Mitt.—LCTemp, ATA.
D. microcarpum (Hedw.) Mitt.—6822, Tiritea R., c. 400 m.
D. puchellum (H. f. and W.) Mitt.—WTemp, LCTemp, NTA, WTA.
D. rotundifolium (H. f. and W.) Broth.—6929, 6973, Mt. Marima, c. 200 m.; 7543, nr. Field Hut, c. 850 m.
Eriopus cristatus (Hedw.) Jaeg.—6867, Tiritea R., c. 400 m.; 7553, 7557, nr. Field Hut, c. 850 m.
E. flexicollis (Mitt.) Jaeg.—7593, nr. Field Hut, c. 850 m.
Pterygophyllum dentatum (H. f. and W.) Mitt.—WTemp, ATA.
P.d. robustum (H. f. and W.) Dixon.—WTemp, ATA.
P. quadrifarium (Hook.) Brid.—UWTemp, LCTemp, ATA.

Hypopterygiaceae.

Catharomnion ciliatum (Hedw.) H. f. and W.—LWTemp, NTA.
Cyathophorum bulbosum (Hedw.) C. M.—WTemp, LCTemp, ATA.
Hypopterygium concinnum (Hook.) Brid.—WTemp, ATA.
H. filicaulaeforme (Hedw.) Brid.—WTemp, NTA.
H. novae-seelandiae C. M.—UWTemp, LCTemp, ATA.
H. setigerum (P. Beauv.) H. f. and W.—WTemp, ATA.

Thuidiaceae.

Thuidium furfurosum (H. f. and W.) Jaeg.—WTemp, ATA.
T. laeviusculum (Mitt.) Jaeg.—WTemp, ATA.

Amblystegiaceae.

Campylium relaxum (H. f. and W.) Broth.—7642, nr. Mt. Hector, c. 1300 m.
Drepanocladus fluitans (Hedw.) Warnst.—LWSubp.

Brachytheciaceae.

Brachythecium paradoxum (H. f. and W.) Jaeg.—7419, Mt. Hector, c. 1400 m.
P. plumosum (Hedw.) Bry. eur.—WTemp, ATA.
B. rutabulum (Hedw.) Bry. eur.—7249, Wairongomai R., c. 100 m.
Eriodon cylindritheca (Dixon).—9137, Akatarawa Saddle, c. 400 m.
Eurhynchium asperipes (Mitt.) Dixon.—7563, etc., nr. Field Hut, c. 850 m.
E. muriculatum (H. f. and W.) Jaeg.—6972, Mt. Marima, c. 400 m.; 6945, Mt. Mitre, c. 750 m.

Analysis of the Distribution of Musci.

Belts	Areas	Sphagnaceae	Andreaeaceae	Calomniaceae	Dawsoniaceae	Polytrichaceae	Fissidentaceae	Grimmiaceae	Dicranaceae	Dicnemonaceae	Leucobriaceae	Pottiaceae	Orthotrichaceae	Splachnaceae	Bryaceae	Leptostomaceae	Mniaceae	Rhizogoniaceae	Bartramiaceae	Hypnodendraceae	Rhacopilaceae	Cryphaeaceae	Hedwigiaceae	Ptychomniaceae	Cyrtopodaceae	Pterobryaceae	Meteoriaceae	Phyllogoniaceae	Neckeraceae	Echinodiaceae	Lembophyllaceae	Hookeriaceae	Hypopterigiaceae	Thuidiaceae	Amblystegiaceae	Brachytheciaceae	Sematophyllaceae	Hypnaceae	Hylocomniaceae	Total (38 families)
No. of genera		1	1	1	1	6	1	2	10	2	1	5	5	1	2	1	1	2	4	3	1	1	1	3	1	1	2	1	4	1	3	5	3	1	2	3	2	1	1	87
Warm Subpolar		1	4	—	—	1	—	4	8	—	—	2	—	—	1	—	—	—	7	—	—	—	1	1	—	—	—	—	—	—	1	—	—	—	2	1	—	1	1	36
Cold Temperate	WTA ..	2	1	—	—	6	5	2	12	1	1	—	2	1	3	—	—	3	1	2	—	—	1	3	—	—	4	—	2	—	3	7	2	—	—	1	2	1	—	67
	NTA ..	1	—	—	—	3	1	2	11	—	1	—	2	—	2	—	—	3	1	1	—	—	1	2	—	—	4	—	—	—	2	3	2	—	—	—	2	1	—	45
	ETA ..	2	—	—	—	3	1	2	8	1	1	—	1	—	2	1	—	2	1	1	—	—	1	2	—	—	4	—	—	—	2	2	2	—	—	1	2	1	—	43
	STA ..	2	—	—	—	3	1	2	8	—	1	—	1	—	2	1	—	2	1	2	—	—	1	2	—	—	4	—	—	—	2	2	2	—	—	--	2	1	—	42
	Total ..	4	1	—	—	6	5	2	13	2	1	—	3	1	3	1	—	3	1	2	—	—	1	3	—	—	4	—	2	—	3	7	2	—	—	2	2	1	—	75
Warm Temperate	WTA ..	—	—	—	1	2	2	1	10	1	1	1	2	—	2	—	—	3	—	2	1	—	—	2	1	1	4	—	—	1	3	4	4	2	—	1	2	1	—	55
	NTA ..	—	—	1	1	3	6	1	13	1	1	3	5	—	3	1	—	3	2	2	1	2	—	2	1	1	7	1	4	1	6	8	6	2	—	2	2	1	—	93
	ETA ..	—	—	—	1	3	2	1	8	1	1	1	5	—	2	1	—	3	—	1	1	1	—	2	1	1	4	—	—	1	4	4	4	2	—	1	3	1	—	60
	STA ..	—	—	—	1	2	2	2	8	1	1	3	5	—	2	2	1	3	2	3	1	1	—	2	1	1	7	—	1	1	5	3	4	2	—	3	4	1	—	75
	Total ..	—	—	1	1	4	6	2	13	1	1	5	10	—	3	2	1	4	2	3	1	2	—	2	1	1	8	1	5	1	7	9	6	2	—	4	4	1	--	114
Grand Total		5	4	1	1	10	8	4	22	3	1	6	12	1	5	2	1	4	7	3	1	2	1	3	1	1	9	1	6	1	7	11	6	2	2	6	4	2	1	167

Sematophyllaceae.

Acanthocladium extenuatum (Brid.) Mitt.—WTemp, LCTemp, ATA.

Sematophyllum amoenum (Hedw.) Dixon.—UWTemp, LCTemp, ATA.

S. contiguum (H. f. and W.) Dixon.—7230, Wairongomai R., c. 100 m.

S. tenuirostre (Hook.) Dixon.—7156, Orongorongo R., c. 600 m.; 7280, Akatarawa Saddle, c. 400 m.; 9124, Ruamahanga R., c. 320 m.

Hypnaceae.

Hypnum chrysogaster C. M.—CTemp, ATA.

H. cupressiforme Hedw.—WTemp, ATA; 7444, Mt. Hector, c. 1400 m.

Hylocomniaceae.

Hylocomnium splendens (Hedw.) Bry. eur.—7430, Mt. Hector, c. 1400 m.

BRYOPHYTA—HEPATICAE.

V. D. ZOTOV and E. A. HODGSON.

As in the cases of mosses, collections of liverworts were made in representative localities. Judging from the fact that a large number of species were collected only once or twice, it would appear that the present list must be by no means exhaustive. It must also be borne in mind that the present knowledge of the New Zealand hepatics is very imperfect, so that errors in identification are likely to have crept in. To facilitate future work, numbers are given of all specimens except of those species well represented in the collection, which is deposited in the herbarium of the Plant Research Bureau, Palmerston North.

The families in the list are arranged according to the system adopted by Verdoorn (1932).

Epigonanthaceae.

Acrobolbus lophocoleoides Mitt.—9209, Akatarawa Sad., c. 400 m.

Anastrophyllum schismoides (Mont.).—6642, 6663, Te Matawai, c. 900 m.

Chandonanthus squarrosus (Hook.).—7174, Orongorongo R., c. 600 m.

Chiloscyphus aculeatus Mitt.—9218, Akatarawa Saddle, c. 400 m.

C. allodonta (H. f. and T.) comb. nov.—9251, Ruamahanga R.; 9175, Ohau-iti R.; 9276, Akatarawa Saddle, all c. 300 m.

C. bidentatus St.—6664, Te Matawai, c. 900 m.

C. Billardieri Nees.—6660, Te Matawai, c. 900 m.

C. ciliatus St.—7677, nr. Kime Hut, c. 1260 m.; 7170, Orongorongo R., c. 600 m.; 6660, Te Matawai, c. 900 m.

C. coalitus Nees.—7281, Ohau-iti R., c. 300 m.

C. Colensoi Mitt.—7295, Ohau-iti R., c. 300 m.

C. cuneistepulus?—7483, 7534, 7545, 9180, 9174, UWTemp, ATA.

C. decipiens Gottsche.—6672, Te Matawai, c. 900 m., 9232, Mt. Pukematawai, c. 1200 m.
C. echinellus Mitt.—7490, nr. Field Hut, c. 850 m.
C. fissistipus H. f. and T.—6983, Mt. Tarakamuku, c. 500 m.; 9215, Akatarawa Saddle, c. 400 m.
C. involucratus Col.—9173, Ohau-iti R., c. 300 m.
C. odoratus Mitt.—7281, Ohau-iti R., c. 300 m.
C.—7414, 7403, 7678, 7689, Mt. Hector, c. 1500 m.
C.—9220,Akatarawa Saddle, c. 400 m.
C.—9209, Akatarawa Saddle, c. 400 m.
C. physanthus Mitt.—4775, Tiritea R., c. 100 m.
C.—7681, nr. Kime Hut, c. 1350 m.
C.—7181, Wairongomai R., c. 50 m.
Cuspidatula monodon (H. f. and T.) St.—6932, Mt. Marima, c. 400 m.; 7305, Ohau-iti R., c. 300 m.; 7465, nr. Field Hut, c. 850 m.
Geocalyx novae-zealandiae Herz.—7285, Ohau-iti R., c. 300 m.
Haplozia rotata H. f. and T.—4759, Tiritea R., c. 100 m.
H.—7498, Mt. Hector, c. 1400 m.
Jamesoniella colorata (Lehm.) ?—7661, nr. Kime Hut, c. 1350 m.
J. Kirkii St.—9245, Ruamahanga V., c. 120 m.
J. occlusa (Tayl.).—7410, Mt. Hector, c. 1400 m.
J. Sonderi.—7418, Mt. Hector, c. 1400 m.; 9256, Ruamahanga R., c. 320 m.
J.—7495, Mt. Hector, c. 1400 m.
Lophocolea crassiretis Herz.—6644, Te Matawai, c. 900 m.
L. decurva Mitt.—7095, 7096, Ohau-iti R., c. 300 m.; 7168, Orongorongo R., c. 600 m.
L, erectifolia St.—7285, Ohau-iti R., c. 300 m.
L. heterophylloides Nees.—WTemp, NTA; 7226, Wairongomai R., c. 50 m.
L. lenta H. f. and T.—6940, Mt. Marima, c. 400 m.
L. muricata Nees.—6668, 6686, Te Matawai, c. 900 m.
L. planiuscula H. f. and T.—4836, Mt. Bannister, c. 1450 m.
L. unduliflora Gottsche.—9170, Ruamahanga V., c. 320 m.
L. Zotovii Herz.—7499, Mt. Hector, c. 1400 m.
L.—7685, nr. Kime Hut, c. 1350 m.
L.—6699, Manawatu Gorge, c. 100 m.
Plagiochila annotina Lindb.—6814, Ohau R., c. 250 m.; 6658, Te Matawai, c. 900 m.
P. arbuscula L. et L.—WTemp, NTA, STA.
P. Beckettiana St.—7640, nr. Kime Hut, c. 1350 m.
P. conjugata Lindb.—7308, Ohau-iti R., c. 300 m.; 9221, Akatarawa Saddle, c. 400 m.
P. deltoidea Lindb.—6825, Tiritea R., c. 300 m.
P. fasciculata Lindb.—WTemp, NTA; 9279, Akatarawa Saddle, c. 400 m.
P. fruticella H. f. and T.—9211, 9208, Akatarawa Saddle, c. 400 m.; 7168, Orongorongo R., c. 600 m.; 7280, Ohau-iti R., c. 300 m.
P. gigantea Lindb.—WTemp, NTA; 9213, Akatarawa Saddle.

P. Helmsii St.?—6690, Te Matawai, c. 900 m.; 9241, Ruamahanga V., c. 320 m.; 7176, Orongorongo R., c. 600 m.
P. Howeana St.—6658, Te Matawai, c. 900 m.; 7456, nr. Field Hut, c. 850 m.
P. Kirkii St.—6717, Mt. Arawaru, c. 600 m.
P. Lyallii Mitt.—WTemp, NTA, STA; 7664, nr. Kime Hut, c. 1350 m.
P. microdictyum Mitt.—7155, Orongorongo R., c. 600 m.
P. multidentata St.—4805, Manawatu Gorge, c. 150 m.
P. ramosissima Lindb.—6653, Te Matawai, c. 900 m.
P. Stephensoniana Mitt.—9247, Ruamahanga R., c. 320 m.; 7579, nr. Field Hut, c. 850 m.; 9214, Akatarawa Saddle, c. 400 m.
P.—9255, 9250, Ruamahanga R., c. 320 m.; 7663, nr. Kime Hut, c. 1350 m.
Saccogyna australis Mitt.—9219, Akatarawa Saddle, c. 400 m.; 9172, Ohau-iti R.; 1714, Ruamahanga R., c. 320 m.
Tylimanthus flaccidus Bergg.?—7133, Orongorongo R., c. 600 m.
T. saccatus Mitt.—UWTemp, LCTemp, ATA.
T.—9263, Ruamahanga R., c. 320 m.

Schistochilaceae.

Balantiopsis convexiusculis Berggr.—9207, Akatarawa Saddle, c. 400 m.
B. diplophyllum (Mitt.).—6893, Tiritea R., c. 300 m.; 7103, Ohau-iti R., c. 300 m.; 7487, nr. Field Hut, c. 850 m.
Schistochila appendiculata (Nees).—WTemp, NTA.
S. Balfouriana (H. f. and T.).—9182, Akatarawa Saddle, c. 400 m.
S. ciliata Mitt.—6674, Te Matawai, c. 900 m.; 9235, Ruamahanga R., c. 320 m.
S. glaucescens Nees.—WTemp, NTA, STA.
S. muricata Herz. et Hodg.—7489, nr. Field Hut, c. 850 m.
S. nobilis Nees.—UWTemp, LCTemp, ATA.
S. repleta (H. f. and T.).—7265, 7291, Ohau-iti R., c. 300 m.
S. splachnophylla (H. f. and T.).—7405, nr. Mt. Hector.
S. unguicularis (H. f. and T.).—6970, Mt. Marima, c. 400 m.

Cephaloziellaceae.

Cephaloziella exiliflora (Tayl.)?—6938, Mt. Marima, c. 400 m.

Trigonanthaceae.

Acromastigum anisostomum (L. and L.) Evans.—6648, Te Matawai, c. 900 m.
A. Colensoanum (Mitt.) Ev.—7294, Ohau-iti R., c. 300 m.
Bazzania adnexa (L. and L.).—UWTemp, LCTemp, ATA.
B. fissistipa St.—7561, nr. Field Hut, c. 850 m.
B. monilinerve (Nees).—9271, Ruamahanga R., c. 320 m.
B. novae-zealandiae Mitt.—UWTemp, LCTemp, ATA.
B. Tayloriana Mitt.—7084, Ohau R., c. 250 m.; 9217, 9218, Akatarawa Saddle, c. 400 m.
B.—6628, Oriwa Lake-Hollow, c. 900 m.
Cephalozia multicuspidata (H. f. and T.)?—7491, 7492, 7493, Mt. Hector, c. 1450 m.

Lembidium ventrosum St.?—7364, 7533, 7606, nr. Field Hut, c. 850 m.
L.—7648, nr. Kime Hut, c. 1350 m.
Lepidozia novae-zelandiae St.—7279, 7297, Ohau-iti R., c. 300 m.
L. capilligera Lindb.—UWTemp, LCTemp, WTA.
L. centipes Tayl.—9252, Ruamahanga R., c. 320 m., 7619, nr. Field Hut, c. 850 m.
L. Lindenbergii Gottsche.—WTemp, NTA, STA.
L. praenitens L. et L.—UWTemp, LCTemp, ATA.
L. spinosissima.—7081, 7299, Ohau-iti R., c. 300 m., 9298, Akatarawa Saddle, c. 400 m.
L. ulothrix Labg.—6659, Te Matawai, c. 900 m.
L. compacta.—7089, Ohau-iti R., c. 300 m.
L.—6685, Te Matawai, c. 900 m.
L.—6938, Mt. Marima, c. 400 m.
L.—6701, Mt. Arawaru, c. 600 m.
L.—9289, Akatarawa Saddle, c. 400 m.
L.—9265, Akatarawa Saddle, c. 400 m.
L.—7275, Ohau-iti, c. 300 m.
L.—6619, Oriwa Lake-Hollow, c. 900 m.; 9290, Akatarawa Saddle, c. 400 m.; 9268, 9275, Ruamahanga R., c. 320 m.
L. carcarata var. *minor.*—7397, Mt. Dennan, c. 1050 m.; 7415, Mt. Hector, c. 1400 m.
L.—6625, 6629, Oriwa Lake-Hollow, c. 900 m.; 7089, Ohau-iti, c. 300 m.; 9269, Ruamahanga R., c. 320 m.
L.—6685, Te Matawai, c. 900 m.
L.—7404, Mt. Hector, c. 1400 m.
Marsupidium albreviatum H. f. and T.?—6698, Manawatu Gorge, c. 150 m.
M. Knightii Mitt.—6816, Tiritea R., c. 300 m.; 7597, nr. Field Hut, c. 850 m.
Psiloclada clandestina Mitt.—9263, Ruamahanga R., c. 320 m.
Zoopsis argentea H. f. and T.—6841, Tiritea R., c. 300 m.
Z. foliosa Herz. and Hodg.—9178, 9297, Akatarawa Saddle, c. 400 m.
Z. Leitgebiana C. and P.—7537, nr. Field Hut, c. 850 m.; 6620, Oriwa Lake-Hollow, c. 900 m.
Z. setulosa Leitgeb.?—9299, Akatarawa Saddle, c. 400 m.
Z.—7619, nr. Field Hut, c. 850 m.

Ptilidiaceae.

Blepharostoma palmatum (Labg.).—7496, 7497, Mt. Hector, c. 1400 m.
Herberta alpina St.—6643, 6667, Te Matawai, c. 900 m.
Isotachis sp. (cf. *I. flavicans* of Chile).—7407, Mt. Hector, c. 1400 m.
I. humectata (Tayl.) *f. calcarata.*—7401, 7409, etc., Mt. Hector, c. 1400 m.
I. Lyallii Mitt.—UWTemp, LCTemp, WTA.
I. montana Col.—LCTemp, WTA.
I. montana f. subdentata.—7649, nr. Kime Hut, c. 1350 m.
Lepicolea scolopendra Nees.—UWTemp, LCTemp, ATA.
Lepidolaena clavigera Gottsche.—WTemp, NTA, STA.

L. magellanica (Gottsche).—9231, Pukematawai, c. 1450 m.
L. Menziesii (Gottsche).—4815, Ohau R., c. 250 m.
L. paepebrifolia (Gottsche).—9265, Ruamahanga V., c. 320 m.
L. Taylori (Gottsche).—WTemp, NTA; 9281, Akatarawa Saddle, 400 m.
Mastigophora flagellifera Nees.—WTemp, NTA, STA.
Trichocolea australis St.—UWTemp, LCTemp, ATA.
T. australis f.—7657, 7659, nr. Kime Hut, c. 1350 m.
T. australis f.—9274, Ruamahanga V., c. 320 m.
T. australis f.—6879, Tiritea R., c. 300 m.
T. lanata Nees.—6875, Tiritea R., c. 150 m.; 7263, Ohau-iti R., c. 300 m.; Ruamahanga R.

Goebeliellaceae.

Goebeliella cornigera (Mitt.) St.—CTemp, LWSubp, ATA.

Radulaceae.

Radula buccinifera H. f. and T.—6889, Tiritea R., c. 300 m.; 6979, Mt. Marima, c. 400 m.
R. grandis St.—6889, Tiritea R., c. 300 m.; 9118, Akatarawa Saddle, c. 400 m.
R. levieri St.—4811, 4773, Tiritea R., c. 200 m.; nr. Field Hut, c. 850 m.; 9169, Akatarawa Saddle, c. 400 m.
R. uvifera H. f. and T.?—7228. Wairongomai R., c. 50 m.

Porrellaceae.

Madotheca Stangeri Gottsche.—WTemp, LCTemp, ATA.

Lejeuniaceae.

Archilejeunia olivacea H. f. and T.—7307, Ohau-iti R., c. 300 m.
Eulejeunia Kirkii St.—7527, nr. Field Hut, c. 850 m.
E. nudipes H. f. and T.—17099, Tiritea R., c. 300 m.
Harpalejeunia Colensoi St.—9189, Akatarawa Saddle, c. 400 m.
" Lejeunia."—6722, Mt. Arawaru, c. 600 m.
" L."—7406, Mt. Hector, c. 1400 m.
Physocolea laevigata (Mitt.).—6812, Tiritea R., c. 300 m.; 6650, Te Matawai, c. 900 m.
Strepsilejeunia Curnowii St.?—6979, Mt. Marima, c. 400 m.
Thysananthus anguiformis (H. f. and T.)—7303, 7097, Ohau-iti R., c. 300 m.; 9179, 9300, Akatarawa Saddle, c. 400 m.

Frullaniaceae.

Frullania deplanata Mitt.—7453, nr, Field Hut, c. 850 m.
F. pycnantha H. f. and T.—7142, 7178, 7180, Orongorongo R., c. 400 m.
F. rostellata Mitt.—7042, Ohau-iti R., c. 300 m.
F. spinifera H. f. and T.—7223, 7235, Wairongomai R., c. 50 m.; 7041, 7025, Ohau-iti R., c. 300 m.
F.—7236, 7240, Wairongomai R., c. 50 m.
F.—6974, Mt. Marima, c. 400 m.

Treubiaceae.

Treubia insignis Goebel.—7284, Ohau-iti, c. 300 m.

Haplolaenaceae.

Calycularia Cockaynei (Goeb.) St.—7674, Kime Hut, c. 1380 m.

Monocleaceae.

Monoclea Forsteri Hook.—WTemp, ATA.

Dilaenaceae.

Pallavicinia connivens (Col.) St.—7607, nr. Field Hut, c. 850 m.
P. xiphioides (Tayl.).—7565, nr. Field Hut, c. 800 m.
P. sp. nov.—9197, Akatarawa Saddle, c. 400 m.
Symphyogyna hymenophyllum Mont.—WTemp, CTemp, ATA.
S. obovata Tayl?—9191, Akatarawa Saddle, c. 400 m.
S. subsimplex.—4767, Tiritea R., c. 150 m.

Metzgeriaceae.

Hymenophytum flabellatum (Mont.) St.—UWTemp, CTemp, ATA.
H. leptodon (H. f. and T.) St.—WTemp, LCTemp, ATA.
H. phyllanthus (Hook.) St.—UWTemp, LCTemp, ATA.
Metzgeria Colensoi St.?—6706, Mt. Arawaru, c. 600 m.
M. decipiens (Massal) Schiff. and Gottsche.—6926, Mt. Marima, c. 400 m.
M. hamata Lindb.—6924, 6980, Mt. Marima, c. 400 m.; 7479, 7555, nr. Field Hut, c. 850 m.; 7680, 7684, nr. Kime Hut, c. 1350 m.
M. nitida Mitt.—7184, Wairongomai R., c. 50 m.
M.—7688, nr. Kime Hut, c. 1350 m.
M.—7481, nr. Kime Hut, c. 1350 m.
M.—7225, Wairongomai R., c. 50 m.

Aneuraceae.

Riccardia alterniloba (H. f. and T.).—WTemp, NTA, STA.
R. bipinnatifida Col.—6984, nr. Manawatu G., c. 200 m.
R. eriocaula (Hook.)—UWTemp, LCTemp, ATA.
R. marginata (Col.) ?—6963. Mt. Marima, c. 400 m.
R. micropinna (St.).—9204, 9205, Akatarawa Saddle, c. 400 m.
R. perpusilla (Col.) ?—7477, nr. Field Hut, c. 850 m.
R. Polymorpha (Col.) ?—Temp, ATA; 7413, Mt. Hector c. 1400 m.
R.—6662, Te Matawai, c. 900 m.
R.—7616, nr. Field Hut, c. 850 m.
R.—6784, nr. Manawatu G., c. 200 m.; 7402, 7417, Mt. Hector, c. 1400 m.
R.—7411, 7416, Mt. Hector, c. 1400 m.
R.—9234, Pukematawai, c. 1450 m.
R.—7474, nr. Field Hut, c. 850 m.
R.—7365, nr. Field Hut, c. 850 m.
R.—6645, Te Matawai, c. 900 m.
R.—7484, nr. Field Hut, c. 850 m.
R.—9233, Pukematawai, c. 1450 m.
R.—6665, Te Matawai, c. 900 m.

Marchantiaceae.

Lunaria cruciata.—4845, 7053, Manawatu G., c. 100 m.
Marchantia foliacea Mitt.—WTemp, LCTemp, ATA.
M. tabularis Nees.—WTemp, NTA; 7587, nr. Field Hut, c. 850 m.
M. sp. nov.—7485, nr. Field Hut, c. 850 m.

Operculatae.

Asterella tenera (Mitt).—7282, Ohau-iti R., c. 300 m.

Anthocerotaceae.

Anthoceros coriaceus?—17145, Manawatu G., 100 m.

ANALYSIS OF THE DISTRIBUTION OF HEPATICAE.

Belts	Areas	Epigonanthaceae	Schistochilaceae	Cephaloziellaceae	Trigonanthaceae	Ptilidiaceae	Goebellellaceae	Radulaceae	Porrellaceae	Lejeuniaceae	Frullaniaceae	Treubiaceae	Haploiaenaceae	Monocleaceae	Dilaenaceae	Metzgeriaceae	Aneuraceae	Marchantiaceae	Operculatae	Anthocerotaceae	"Aplozia"	"Schizma"	Total.
No. of genera		12	2	1	8	7	1	1	1	6	1	1	1	1	2	2	1	2	1	1	[1]	[1]	52
Warm Subpolar		14	1	—	4	6	1	—	—	1	—	—	1	—	—	3	5	—	—	—	1	—	37
Cold Temperate	WTA ..	6	3	—	12	4	1	1	1	1	1	—	—	—	3	4	7	3	—	—	—	—	47
	NTA ..	12	2	—	8	5	1	—	1	1	—	—	—	—	1	3	5	1	—	—	—	1	41
	ETA ..	1	1	—	4	3	1	—	1	—	—	—	—	—	1	3	2	1	—	—	—	—	18
	STA ..	3	1	—	3	3	1	—	1	—	—	—	—	—	1	3	2	1	—	—	—	—	10
	Total .	16	4	—	18	6	1	1	1	2	1	—	—	—	3	4	10	3	—	—	—	1	71
Warm Temperate	WTA ..	3	1	—	4	2	—	—	1	—	—	—	—	1	1	3	2	1	—	—	—	—	19
	NTA ..	28	6	1	16	9	—	3	1	6	3	1	—	1	2	6	6	3	1	1	—	—	94
	ETA ..	7	2	—	7	6	—	—	1	—	—	—	—	1	1	3	2	1	—	—	—	—	31
	STA ..	23	4	—	11	6	—	3	1	2	3	—	—	1	3	5	5	1	—	—	—	—	68
	Total ..	43	9	1	24	11	—	4	1	7	5	1	—	1	4	8	7	3	1	1	—	—	131
Grand Total		63	11	1	38	20	1	4	1	9	6	1	1	1	5	10	18	4	1	1	1	1	198

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